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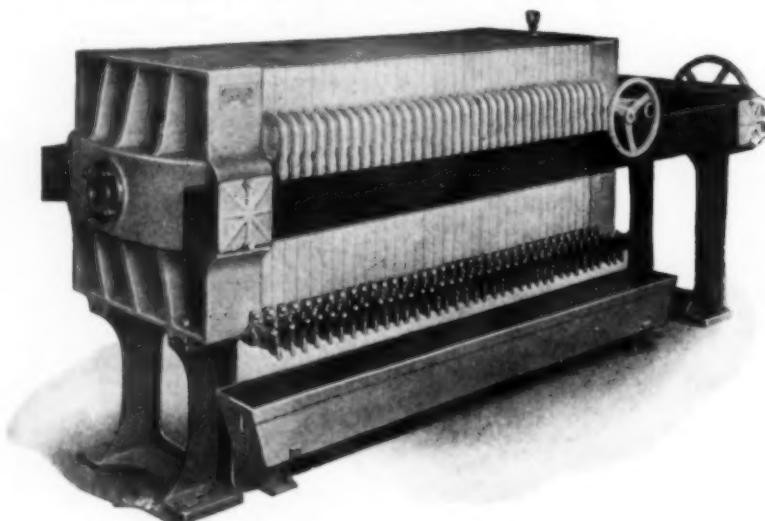
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CHEMICAL & METALLURGICAL ENGINEERING

McGRAW-HILL COMPANY, INC.
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Hysteria in Excelsis

THE CHEMICAL industry can scarcely afford to sit idly by and view with equanimity the casual manner in which the fortunes of one of its branches have been rudely thrown into balance by the hysteria of a newspaper and a physiologist. Whatever the merits or demerits of tetra-ethyl lead and ethylized gasoline, the products should not be summarily condemned as a menace to health nor should the manufacturers be pilloried as inconsiderate profiteers without a thorough-going investigation. And an investigation consists in something more than a self-glorifying crusade by a newspaper or the opinions of a college professor of physiology.

CHEM. & MET. holds no brief for the Ethyl Gasoline Corporation or its products, and if, on careful investigation by qualified critics, the business shall be found inimical to the public health, we shall not mourn its untimely end. But at present it is a branch—and potentially a great branch—of the chemical industry of this country and as such is entitled to reasonable consideration. The research that developed tetra-ethyl lead as an "anti-knock" was conceived in a fine spirit of industrial progress looking toward the conservation of gasoline and increased efficiency of internal combustion motors. It carried in its train, as such developments are likely to do, a number of others new in American chemical industry. The business was no fly-by-night venture, and its known hazards were safeguarded to the best of human ingenuity and ability. Its casualties were negligible compared to human sacrifice in the development of many industrial enterprises.

IT IS unfortunate, therefore, that the train of events of the past two months has developed a public controversy over this product that has been characterized by intemperate criticism and hysterical headlines. One can imagine how chemical progress in the past might have been hampered by a similar crusade by self-appointed guardians of the public health. If cyanide had suffered a similar

onslaught we might never have developed the process of ore treatment by which the bulk of the world's gold is now recovered. If chlorine had come under the ban of the daily press we might be without a valuable industrial chemical, a potent antiseptic, and a purifier of municipal water supplies. Instances might be multiplied to show that deadly poisons have their beneficent uses and that industrial progress and human welfare have benefited from their proper application despite occasional fatal accidents. City gas and motor exhaust still claim their victims almost daily, but escape the tender ministrations of the crusader.

WHAT IS needed in the present situation is sanity and judicial consideration, and for these elements we must look to the conference called in Washington on May 20 by Surgeon General Hugh S. Cumming, of the Public Health Service. It has been publicly stated that the conference will include physicians, pathologists, representatives of the automobile industry and chemists. We have urged General Cumming to recognize the importance of the last-named group. Inasmuch as a branch of the chemical industry is on trial, competent and impartial representatives of the industry as a whole should not only be among the witnesses but also on the jury. Only in this way can the Surgeon General assure himself of the benefit of expert advice on the competence of the tests already completed or yet to be made.

THE CONFERENCE has a momentous question to decide, and the general acceptance of its conclusions will depend in large measure on its freedom from bias, its distinction between fact and opinion, and the general intelligence displayed in its deliberations. The chemical industry has no desire to be either a nuisance or a menace, but it does want a reasonable degree of assurance that it is not to be tried and convicted by incompetent critics or forced to abandon its legitimate pursuits by misguided zealots.

An Outstanding Development In Sulphuric Acid Manufacture

JUST what determines the point of diminishing returns in the concentration of sulphuric acid is, to a certain extent, governed by local conditions. It is safe to say, however, that concentration of chamber acid beyond 93 per cent H_2SO_4 does not yield a commensurate manufacturing profit when fuel, repairs and depreciation are fairly reckoned. Likewise, mixing chamber acid with oleum has a definite lower economical limit. These limits are such that the profitable manufacture of acid of intermediate strength, say 92 to 96 per cent H_2SO_4 , has become a vexatious problem for the producer who would compete successfully in this important market.

Fortunately for the industry, the efforts of one such producer have yielded a sound and remarkably simple solution in the development of the Stantial divided Glover tower, the design and operation of which is discussed elsewhere in this issue. By utilizing waste heat from the sulphur burners, and with no great increase in invested capital, 66 deg. Bé. acid can be made at a saving of at least \$1.50 to \$2 per ton compared with the cost of manufacture in existing combinations of chamber plant and detached concentrating system. Furthermore, for making acid intermediate in strength between 66 deg. Bé. and oleum, the new tower can be operated to advantage with contact-process units.

Coming as it does at a time when the demand for strong acid is increasing with rapidity, the development of the Stantial divided Glover tower marks an advance in technology that deserves front rank position as an accomplishment of chemical engineering in the sulphuric acid industry.

A Balanced Force Intensely Modern

NO LESS an authority than President Coolidge has described our need for military preparedness, despite the United States' peaceful intentions toward all the earth, as "a balanced force, intensely modern, capable of defense of sea and land, beneath the surface and in the air." Major General Amos A. Fries, Chief of the Chemical Warfare Service, has rightly interpreted this comment as defining a responsibility to include the most modern chemical weapons of offense and defense in our program of preparedness. About one-third of the casualties of the World War among American troops were caused by gas. But only one-third of one per cent of the appropriation for the War Department activities is devoted to chemical warfare. Certainly this is not a proper ratio. It makes impossible a well balanced defense.

The most serious aspect of this situation is the inability of the Chemical Warfare Service to continue the needed chemical, mechanical and medical research. About \$250,000 from the total appropriation is the maximum which can be allotted for research during the coming year. This will maintain a staff of fewer than fifty chemists and chemical engineers, even including those who can be added to the staff because the navy has appreciated the importance of stimulating chemical warfare research and has transferred funds for this purpose for several years past. Three times this sum for chemical research would just about cover the im-

portant and immediate needs of the service. Without this larger support the research is going to be seriously curtailed and often will be delayed until its usefulness is almost past.

There are two ways in which chemists and the chemical industry can aid in this situation. In the first place the industries can offer their facilities in co-operation with the Chemical Warfare Service more actively than in the past, generous as they have already been. And the chemists themselves can lend their moral support to the cause by membership in the U. S. Chemical Warfare Association. This group is working for the good of the Service and is rendering a patriotic service of importance. Those who are prepared to lend their personal support by membership should get in touch with the secretary of the Association in Washington. The dues are small and the responsibilities assumed light, but the moral support and encouragement thus given will be great.

A Golden Opportunity For the Fertilizer Industry

THE consolidation of the Southern Fertilizer Association with the National Fertilizer Association is now assured and will take place at the June meeting in White Sulphur Springs. This is a recognition by the best minds in the fertilizer business that a truly national body is essential to deal on a progressive basis with the fundamental problems of the industry.

This industry has long run with little research guidance. It has even fought against the development of concentrated fertilizer and has been unwilling in many plants to take advantage of scientific developments made by state agricultural experiment stations or the U. S. Department of Agriculture. Its business methods have been far from sound economically and the competition between companies has been of medieval cut-throat type. Now comes a golden opportunity for the business. The new association will start with a clean slate and a reputation yet to be made. If the personnel of the organization is wisely chosen only success can be anticipated in its larger, newer efforts.

To realize upon these possibilities the industry must do three things: First, it must give absolutely unanimous financial support to the new organization, every company joining and paying its quota of the national expense. Second, the association and its membership must take an entirely new stand toward chemical engineering research in the manufacture of fertilizers and toward agricultural research in their use. This means co-operation with state and federal investigators and a stimulation of modern technology and accurate plant control in the works. And third, its most important responsibility will be to establish a sound public relations policy.

Even the best of executive officers, and only the best must be chosen, cannot maintain the reputation of the industry before the agricultural public and government officials if the industry continues some of its highly undesirable practices. No amount to talk about good business methods will carry any weight so long as cut-throat competition and deferred price adjustments are practiced in selling fertilizer. No amount of propaganda claiming a desire to aid the farmer will be convincing if the legislative staff of companies or of the association itself indulges in antiquated

political wire-pulling which is no longer either fashionable or effective. No amount of splendid work, such as has been done by the soil improvement committees of the two associations, will give the right relationship with the farmers if the principal members of the association continue to oppose the sound scientific services offered by state and federal investigators. Fighting "concentrated" fertilizer has done as much to damage the industry in the eyes of the farmers, as the lack of scientific research has done to manufacturing methods and costs.

All of this clearly points to the necessity of selecting to head the active machinery of the new association a man of outstanding ability, of unquestioned integrity and of known public-service motives. Such a man will not be easy to find. His salary cannot be meager. But diligent search will find the right man, possibly somewhere outside the industry itself, and the reward for such a selection will be tremendously increased opportunity for the industry as a whole. Certainly there never has been a greater opportunity presented to the fertilizer trade.

Influence of Surface Exposure In Adsorbents and Decolorizers

RECENTLY we commented editorially on progress in the adaptation of char as a "precipitant" of metal from leach solution, emphasizing the fact that a quarter of a century had elapsed before an efficient method of utilization was suggested as a result of an alternative interpretation of the theory of the reaction—that abstraction of the metal or metallic compound by the char was due to surface action, and that the use of the char in a finely divided form was logical.

In the sugar industry, the use of lump char for the purification of juice is a practice that must inevitably be displaced in course of time, to make way for a type of decolorizer that is quicker and more efficient, thereby speeding up one step in the process that now absorbs a large proportion of the total time of refining. The clumsiness of the ordinary battery of char filters, the unavoidable dirt, and the labor required for handling the material and the amount of capital locked up in consequence of the tonnage of coarse char needed—all these are obvious disadvantages of existing practice in many plants. The change to the use of finely divided char would speed and systematize the process, reduce factory space for this phase of operation to an insignificant proportion of what is now needed, and necessitate less investment for plant and material. Moreover, the revivification of coarse bone char involves disintegration, and necessitates the removal of the fine material so formed. Although it would seem logical to make use of the undersize, possibly ground still finer, in the refinery, it is often sold for what it will fetch, at a price far below its worth as a decolorizing medium. The main objection against the substitution of fine for coarse char is seen in the economic difficulties in the way of scrapping existing equipment, representing the investment of considerable capital, and the disorganizing of a scheme of processing that is probably functioning smoothly and with a high degree of technical efficiency.

The clarification and decolorizing of sugar juices are complementary operations, and it is interesting to note the progress made in recent years in the utilization of an inert filter aid such as prepared kieselguhr, or dia-

tomaceous earth. The methods available for the revivification of kieselguhr and bone char, respectively, are distinct; but it is possible that research may point a way to the use of a mixture of prepared kieselguhr and clay, as a combined filter aid and decolorizer, the bulk revivification of which would seem to present no insuperable difficulties. The scope for prepared clay as a decolorizer has expanded rapidly of late, and the new product is finding wide application in vegetable- as well as in mineral-oil refineries.

Recognition of the importance of surface exposure as a vital factor in the efficiency of a decolorizer has led to further and still further comminution and subdivision of the material used, whether of animal, vegetable or mineral origin. The need for such subdivision has been demonstrated. Ahead lie vast opportunities for refinement in the preparation of adsorbents and unlimited opportunity in the determination of their scope for the solution of many problems that confront the technical and semi-technical industries.

Eliminating Unfair Competition From International Trade

MANUFACTURERS of chemicals and equipment who expand their domestic business into foreign trade soon realize that they are confronted with new problems in protecting industrial property in the form of trade marks and patents. Difficulties increase disproportionately to the expansion of business. While it may be a comparatively simple matter to protect oneself against piracy and infringement at home, the difficulty of preserving one's reputation against unscrupulous international competitors increases rapidly.

The necessity for discouraging and preventing unfair practice of this kind has long been recognized. The first attempt to provide international protection for industrial property was made in 1883 when the International Union for the Protection of Industrial Property was established by 21 nations. Since that time other countries have agreed to the original convention which now embraces 40 sovereign states and colonies. Each country accords to the nationals of member states the same protection enjoyed by its own citizens, and assures them against acts of unfair competition; but the convention still leaves "unfair competition" undefined. In order to remedy this defect the Industrial Property Committee of the International Chamber of Commerce has undertaken to define special acts that should be regarded as coming within the prohibition of unfair competition, and to secure appropriate amendments to the international convention.

Thus it has been agreed to insert a clause providing that acts calculated to mislead the public in the use of a particular product or in dealing with a particular trader, acts amounting to trade libel and acts leading to a breach of obligations under a contract shall give rise to an action by the parties aggrieved. The contracting states are also to prevent the use of a false indication of origin of merchandise as well as false trade descriptions. The cancellation of improperly registered trade marks will be accomplished by a clause which, if adopted, will permit foreigners to apply at any time within 5 years for the cancellation of the registration of pirated trade marks. The committee has also dealt with the subject of patents and has recommended an amendment to the convention with a view to insuring absolute priority rights for 12 months

within which to apply for patent protection in foreign countries. It has also recommended that sanction for the non-working of a patent in a foreign country should not be forfeiture but the grant of compulsory licenses. These matters will probably be brought before the International Union for action at its next meeting at The Hague, October 8, 1925.

Manufacturers whose foreign trade develops problems in the protection of their industrial property will find the committee of the International Chamber of Commerce an influential body in expressing their views. The committee has apparently succeeded in effecting a number of reforms that will make international trade more attractive and profitable.

Technique In Overalls

ON THE completion of a research the chemist is often inclined to believe that the problem of manufacture is nine-tenths solved. As a matter of fact it is rarely more than one-tenth done. The manufacturing work of the Chemical Warfare Service at Edgewood Arsenal has furnished an unusually striking example of this fact in the plant for manufacturing tear gas, chloracetophenone.

At the outset the research work on this gas indicated no serious plant difficulties and production was reasonably successful from the beginning. But the product proved expensive, costing about \$6 per pound for operating expense alone. Improved methods were developed by mechanical and chemical research, but the largest improvement came through the increasing skill of the plant operatives. By painstaking, conscientious effort these men gradually acquired a technique which has made possible a great increase in operating efficiency. Now the manufacturing cost, were the plant to be started again, would be less than \$1 per pound, or roughly fifteen per cent of the cost during the early stages of manufacture.

It is the refinement of production detail that has made these decreased costs possible. "Technique in overalls" is General Fries' characterization of the contribution which the plant operating staff has made. This will suggest to other plant executives the question whether much of their own success may not be the result of conscientious and painstaking effort by the staff which is made up of skilled plant operators. All too often that group gets little credit.

Anomalies in Technical Nomenclature

A SUCCESSFUL writer remarked recently that, after a period of youthful exuberance that failed to produce tangible results, he had quit trying to correct the illogical. Many anomalies in nomenclature are so well established that it is futile to expect that logic will be considered before usage as a deciding factor. Those who use words as tools, however, are inclined at times to take their task seriously, to rebel when they are obliged, so to speak, to use a pumpkin as a tack hammer or a razor blade as a screw driver. They like to remind themselves that, although custom and usage may be in a position to dictate, compliance in an illogical adherence to custom is revocable at any time; and it is refreshing to assert independence by an occasional

reversion to logical selection. Hence we would like to speak of a chemical nutrient, instead of a chemical fertilizer, because, as we understand it, the word "fertilization," used in its logical and primary sense, is a specific term synonymous with "fecundation," which is only indirectly dependent on nutrition. Gardeners will remember that the addition of a so-called fertilizer to the soil around a nasturtium plant results in nothing more than profuse foliage. Were we, accepting current usage, to discourse at one and the same time on true fertilization by pollen, the function of a moth or fly that acted as a fertilizer, and the use of a "fertilizer" such as guano or nitrate, we would be hard put to preserve clarity.

Similarly, custom and usage dictate that we shall speak of a sterilizer as a retort, because, forsooth, it looks so much like the piece of apparatus in which material is subjected to distillation! A term such as this is introduced by an operator in the industry, without thought. In a few years' time it creeps into a dictionary, and so usage becomes justified; and our descendants will wonder why we remained passive while the corruption of language was taking place.

We confess to corrective impotence. Wrong words are persistently used by people of discernment and perception, even by scientists, and correction is unwelcome. Every technical industry is hampered by the retention of nomenclatural absurdities; but as we said at the commencement of this note, the displacement of the illogical is a hopeless task. Utopia is probably situated in the South Seas, so named because Balboa was looking south when he first saw the Pacific Ocean from the Heights of Darien. But, although proved illogical, the name has stuck, and will be retained in spite of all attempts at reform.

A Final Answer

To the Heat Content Question

SOME MONTHS ago we had occasion to point out in these columns that the agitation in the gas industry looking toward a reduction in B.t.u. standards for manufactured fuel gas without a commensurate reduction in the cubic foot cost was unjustified. It was our contention that manufactured gas—coal gas, carburetted water gas or a mixture of the two—should be valued only on the basis of its heat content per cubic foot and that other measures of value were not germane.

This stand met with much disapproval from various members of the gas-making industry. They seemed to think our position unjustified and to feel that we were to be classed with the youth who threw an egg into an electric fan just to see what would happen. These critics would not admit our contention that what the gas user was primarily interested in was the most heat per dollar of his gas bill and that, while it was perfectly permissible to consider reduction in B.t.u. standards, when such reductions would result in more efficient gas manufacture, proportionate reductions in gas cost to the consumer must be made at the same time.

Various arguments were advanced to prove that the attitude of the gas industry had been misunderstood. There was, however, a distinct impression left in the mind that, in some quarters at least, there had existed this desire to reduce heat standards without a corresponding reduction in cost to the user. This impression was somewhat strengthened when, in November, 1924, a "Report of the Detroit Testing Laboratory to

the Common Council of the City of Detroit" attempted to show that, as the result of tests, it had been proven that 530 B.t.u. gas, when sold at the same price as 600 B.t.u. gas, gave more economical service. With reference to this report, and proving our previous contention, it is with pleasure that we present elsewhere in this issue the summary of an investigation made by the Bureau of Standards into the Detroit tests and of a series of similar tests made by the Bureau. This summary is short, but to the point, and it seems to show conclusively that reduction in heat value does have a very definite effect on the economy of use of a fuel gas by the average consumer.

Making the Most of Process Possibilities

THE SUCCESSFUL operation of any chemical engineering industry must be based on a thorough knowledge of the chemical and physical processes involved. But it should be recognized that such knowledge is not enough. The tools by which the process is carried out, the unit process equipment, must be that best suited to the work in hand if truly successful results are to be obtained. The stills, filters, evaporators, reaction vessels, pumps, conveyors, or whatever else is employed in the process must be chosen with extreme care as to their fitness for the work if the full economic possibilities of the industry are to be realized. The same pains that are taken to insure the use of correct technology should be used in making certain that the equipment employed is the best that can be obtained for the particular purposes for which it is purchased.

At first glance it would seem so obvious that these precautions are necessary that those interested would employ them without fail. Unfortunately, however, that is not the case, as is evident from the great number of plants which are achieving only half-way results. Too often, equipment is purchased on the basis of price alone or without a thorough investigation of the opportunities afforded by other devices than those selected. Too often, chemical manufacturers fail to put all the conditions of service and all the performance requirements openly before the equipment designer or builder. The old, outworn tradition of secrecy in chemical manufacture still blinds the eyes of too many to their own best interests.

As a result, many plants are operating at efficiencies much below those that might be attained if the best possible in equipment had been installed. In one case, it may be, much power could be saved and a better and more uniform product obtained if the crushing and grinding equipment had been chosen for performance rather than cheapness. Or, perhaps, if the filter salesman had known just what his filter was expected to do, he might have sold a different design, one which would have given better results. Or, again, if the plant engineers had given as much study to the type of drier installed as they did to the drying process, heat bills might have been cut in half.

There are, then, three things that plant operating engineers can do, in order that the performance of the process equipment may be on the same level of excellence as the technology of the process. First, make it a rule to buy always on performance, never on price. Second, do not have too many secrets from the man who makes the equipment. Let him know the

materials it is to handle, the conditions under which it is to operate and the results that it must give. Do not treat equipment salesmen as spies, to be kept out of the plant at all costs. Remember two things, first that no one knows everything there is to know and second that the equipment salesmen see a great deal and consequently are in a position to be of real service to their customers.

And finally, miss no chance to become familiar with the latest developments in the equipment field. Read the advertising pages of the technical papers and, above all, take the time to attend such exhibitions of chemical engineering equipment as that to be given in Providence during the week of June 22, in conjunction with the meeting of the American Institute of Chemical Engineers. There can be little of greater benefit to the average chemical engineer than to study the exhibits at such a show and to meet and talk with the engineers who design and construct the equipment.

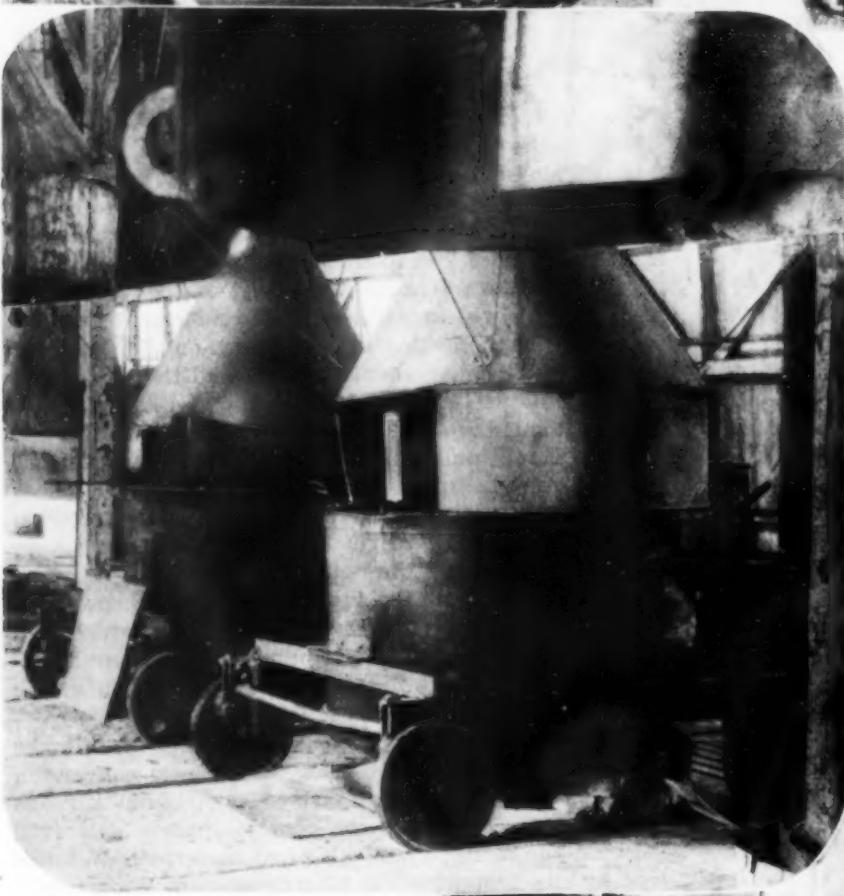
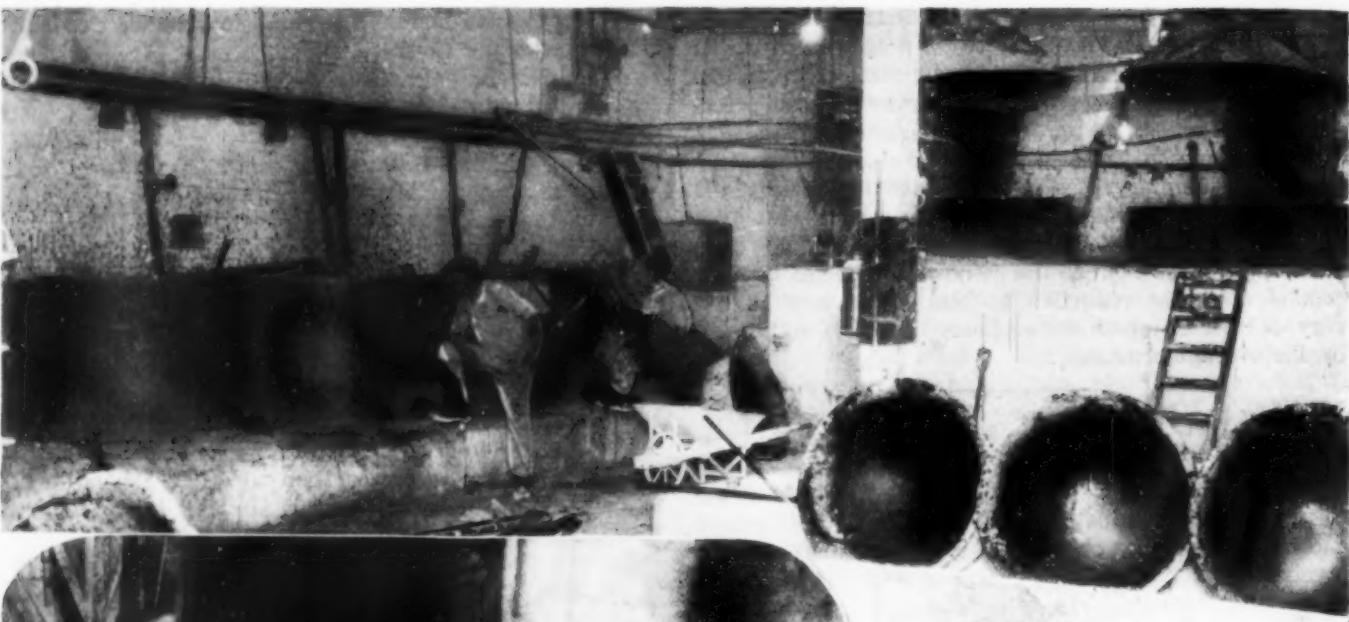
To See Ourselves As Others See Us

THE SAYINGS of foreign chemists while they are among us are usually entertaining. The impressions related to their own countrymen after their return home, away from the immediate influence of hospitality, are usually more illuminating. It is therefore interesting to note what Dr. E. C. C. Baly, of the University of Liverpool, well-known biochemist and recently in the public eye in connection with his work on the synthesis of sugar, had to say about America and the Americans at a recent meeting of the Institute of Chemistry.

His comments on the dominant characteristics of the average Englishman and of the average American are accurate and pertinent. The American, he avers, lacks self consciousness and responds readily to fraternal advances, with the result that a mere acquaintance ripens into friendship so quickly as to be interpreted as "scarcely decent" by the insular Briton. He speaks of American friendship for England, based on respect and appreciation; and pays a tribute to American hospitality. He confesses to a sense of exhilaration at the American faculty of constructive criticism.

Dr. Baly recognizes the good work being done in the greater American universities, and admits conversion to the American practice of state-endowed institutions of this kind. He notes the contact that is preserved between the alumnus and his *alma mater*, the welcome that awaits him when he returns and the opportunity that exists for him to further the work and influence of the college from which he was graduated. In England all is different. The retention of membership after graduation—the payment of a fee to "remain on the books"—is not encouraged; and the returning graduate is welcomed with the same warmth that would be shown to an itinerant vendor of kitchen utensils, especially if his work has taken him overseas meanwhile.

American chemists are fortunate in many ways; but let it not be forgotten that progress here is largely due to the freedom with which intellectual friendships can be made, to the ease with which knowledge can be acquired or exchanged and to the absence of an innate hostility to co-workers of any other nationality. Untrammeled intercourse and mutual trust will play as conspicuous a part in the future as they have in the past in the advance and the consolidation of the profession of chemical engineering.



TOP—Here are shown the kettles used for boiling linseed oil which is the first step in the preparation of the cement that acts as a binder in linoleum composition.

MIDDLE—Two of the steel kettles used for boiling the oils and gums that are used in making the varnishes and enamels used in oil cloth manufacture.

BOTTOM—All the paints and enamels used in making linoleums, felt-base floor covering and oil cloths must be ground to a perfectly smooth consistency on machines like these before use.

**Some
Preliminary Steps
in the
Manufacture of
Floor Coverings**



Manufacture of Floor Covering

Linoleum, Felt Base Flooring and Oil Cloth are Products of a Large But Little Known Industry Using Chemical Engineering Methods

THE TOUGH skin of oxidized linseed oil that forms when a can of paint is left exposed to the air may mean little to most of us yet it is the basis of an industry that provides one of the best-known comforts and conveniences of our modern existence. Many years ago an Englishman by the name of Frederick Walton began to experiment with this film of linseed oil and the commercial production of linoleum and similar floor coverings resulted from his studies.

In the United States, paint and varnish making is one of the oldest of the group of industries now recognized as being based on the processes of chemical engineering. The manufacture of floor coverings is a closely allied industry not only because it uses practically the same raw materials and manufacturing processes—but also because its finished product serves a similar purpose as a protective coating for wood and metal surfaces. Recently it was our privilege to observe the processes of linoleum manufacture in the plant of the Certain-teed Products Corp. at Philadelphia. This plant is one of the oldest in the industry, for it was formerly operated by Thomas Potter Sons & Co., who started in business in 1837. Yet in many ways it is one of the most modern, for manufacture has been kept abreast of developments in technology; chemical control and chemical engineering methods of production have become an inseparable part of the industry's operations.

HOW LINOLEUM IS MADE

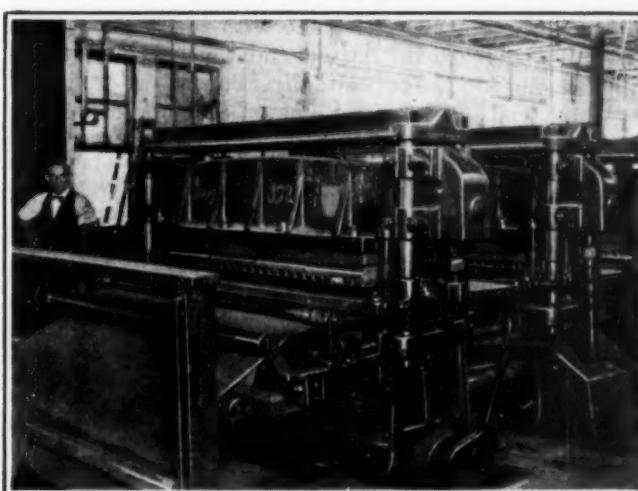
There are three chief products of the plant: Linoleum, the felt-base floor covering known as Floortex, and table oil cloth. Linoleum consists of pulverized cork, wood flour, pigments and various dry colors cemented together with a product of linseed oil and firmly fastened to a burlap backing. The newer, and perhaps more popular, felt-base floor coverings are made of rag felt that has been saturated with asphalt and given a wear-resistant coating of paint and enamel on which are printed the conventional patterns and decorations. Oil cloths, as the name implies, are lighter fabrics that have been finished with several coats of linseed oil, paint or enamel. The principal steps in the manufacture of these products may be traced in the accompanying illustrations and in the brief description that follows.

The manufacture of linoleum is a time-consuming process, for almost half a year elapses from the time the linseed oil arrives in the plant until the finished product is loaded on the cars. The first step in the process is in the preparation of the boiled linseed oil, which is the principal ingredient in the cement that acts as a binder in linoleum composition. At the Philadelphia plant the oil is heated to about 325 deg. F. in iron kettles and small amounts of red lead and litharge are stirred in until they are thoroughly dissolved. Then, from an overhead trough, boiled linseed oil is flooded over cotton scrim curtains, 6 ft. wide and 15 ft.

long, which are hung vertically from iron rods spaced about 2 in. apart. The oil film deposited on each curtain soon oxidizes for the scrim house is kept at a temperature of around 120 deg. F., and the flooding is repeated at 8 hr. intervals for a period of 2 months, during which time the curtain has acquired a thickness of about 1½ inches. The curtains or skins of oxidized linseed oil are then cut down and ground up for use in making the linoleum cement.

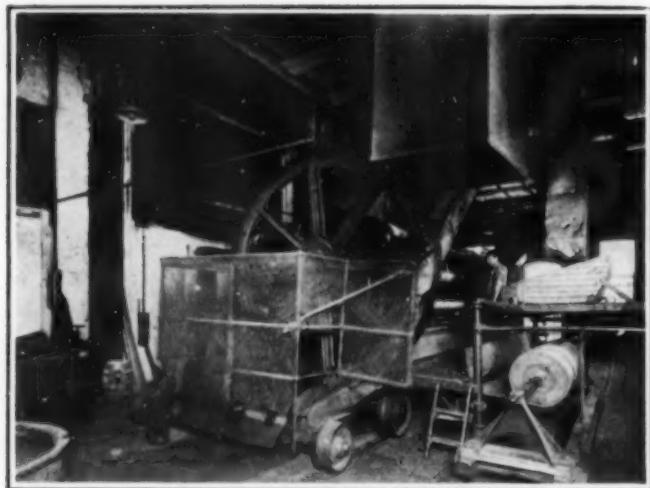
This cement is prepared in 2,500-lb. batches in steam-jacketed kettles equipped with agitators. Fossil gums and rosin are melted, the oxidized oil is added, and the mass is cooked until it becomes extremely thick and viscous. It is then dumped into bays and after cooling is cut into large pieces and aged for 3 to 4 weeks. The finished cement, which is dark reddish brown in color, and tough and rubberlike, is incorporated with the other ingredients—pulverized cork, wood flour and pigments—in kneading-type mixers, from which the linoleum composition emerges in putty-like consistency. For its further fabrication into the finished inlaid linoleum two processes are used—producing so-called straight-line linoleum and the granulated (or molded) type. These will be described separately.

For making straight-line inlaid linoleum, the composition is put through two-roll mixers several times and is then rolled on three-roll calenders into sheets 19 in. wide which are cut into 6½-ft. lengths. The sheets of composition are taken to the straight-line machine, which consists of a flat bed bridged by four sets of heavy cast-iron heads that slide up and down on round steel columns. Under each head is a die plate with openings corresponding to the units of a given color in the pattern of the finished linoleum. A sheet of composition is laid on each die plate and as the heads, which are driven by hydraulic pressure, descend they



Flat Bed Press for Linoleum Making

This machine is used for making straight line inlaid linoleum. Note the heads, operated by hydraulic pressure, which cut out the units of the pattern and press them onto the burlap which is being unwound beneath



Heavy Steam Heated Calenders

This machine is used for making plain and battleship linoleums. Note the reel carriage on rails for convenience in handling reels of burlap

cut out the units of pattern, push them through the openings in the plates and press them onto the burlap beneath with just sufficient pressure to make them adhere. As the heads rise, new sheets are substituted and the burlap is moved forward mechanically to the next head so that the units cut by these dies are set exactly in their proper position with relation to the previously applied units. Finally when the burlap has passed under all four heads a complete pattern—in as many colors—has been laid on the burlap, which serves as a carrier and backing for the goods. After inspection, during which minor defects are repaired, the linoleum is pressed between 2 hydraulic presses operating under high pressure. The platens of the presses are steam heated—and the combination of the heat and pressure welds the blocks of composition together to produce a smooth and even surface. The linoleum is cut into 90-ft. lengths, laid flat on a rack and cured for several weeks at 150 deg. F. It is then trimmed, inspected, crated and shipped.

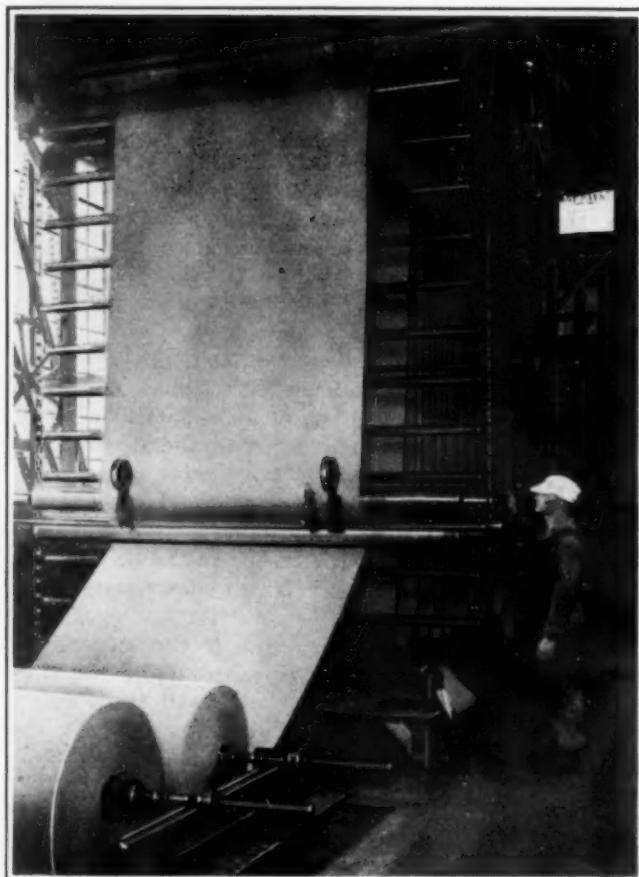
Much the same result is obtained by a quite different method in the case of the granulated or molded inlaid linoleum. The composition as it comes from the mixers is put through a "scratcher" in order to reduce it to granulated form. The scratcher consists of three rolls set in the same horizontal plane with the axes parallel. The first roll is steam heated and the one next to it, which revolves in the opposite direction, is water cooled. The third roll, of larger diameter and operated at a greater speed, has a number of short pins projecting from its surface and is set so these pins just clear the second roll. As the linoleum composition is fed onto the first pair of rolls it adheres to the second or cooled roll and is immediately scratched loose in the form of fine granules by the pins of the third roll. The size of these granules is further reduced in a disintegrator and the product is sieved before it is taken to the granulated inlaid machine.

This machine differs from the one previously described principally in that instead of the four cast-iron heads that operate the die plates, there are four "pans" carried on the channel iron frames at the sides of the flat bed. The bottom of each pan is an aluminum plate in which is cut the stencil for all parts of the pattern of a single color. On the under side of the plates are narrow strips of aluminum that serve to out-

line each opening. The pans are completely filled with the granules, the excess composition is scraped off and then the contents remains on the burlap backing. The pans are then raised and the burlap is moved forward the width of the pans when the operation is repeated. After the pattern is completed and the goods leave the machine they are pressed by steam-heated hydraulic presses that serve to weld the granules into a continuous sheet and cause the composition to stick firmly to the backing of the burlap. The linoleum is then cured, trimmed, inspected and is crated for shipment.

PLAIN AND BATTLESHIP LINOLEUM

Linoleum composition made in granular form by the Walton method just described—or by a modification known as the Taylor or Corticine Process—is also used in making plain and battleship grades of linoleum. These are made on a burlap back in solid colors, usually brown or green. If the thickness is less than $\frac{1}{8}$ in. the material is known as plain linoleum, while if greater than $\frac{1}{8}$ in. the product is referred to in the trade as battleship linoleum. The latter goods are sometimes $\frac{1}{4}$ of an inch in thickness. Plain and battleship linoleum are made on calenders that consist of two 40-in. cored steel rolls mounted one over the other on a heavy cast-iron frame. The rolls are steam heated and so mounted that the clearance between them can be accurately adjusted to correspond to the desired thickness for the finished product. The granulated linoleum composition is fed onto the burlap just before it passes between the calender rolls, which press it into a compact layer of uniform thickness. The plastic sheet of linoleum is run from the calenders into heaters where it is hung in



Looping Machine for Felt Base

This machine festoons the rag felt into loops 10 ft. long just prior to the time it is saturated with asphalt

festoons over iron pipes, each loop being 45 ft. long, thus containing 90 linear feet of goods.

A thin grade of the linoleum thus made has a colored pattern printed on its surface, but most of this material is sold as plain or battleship linoleum.

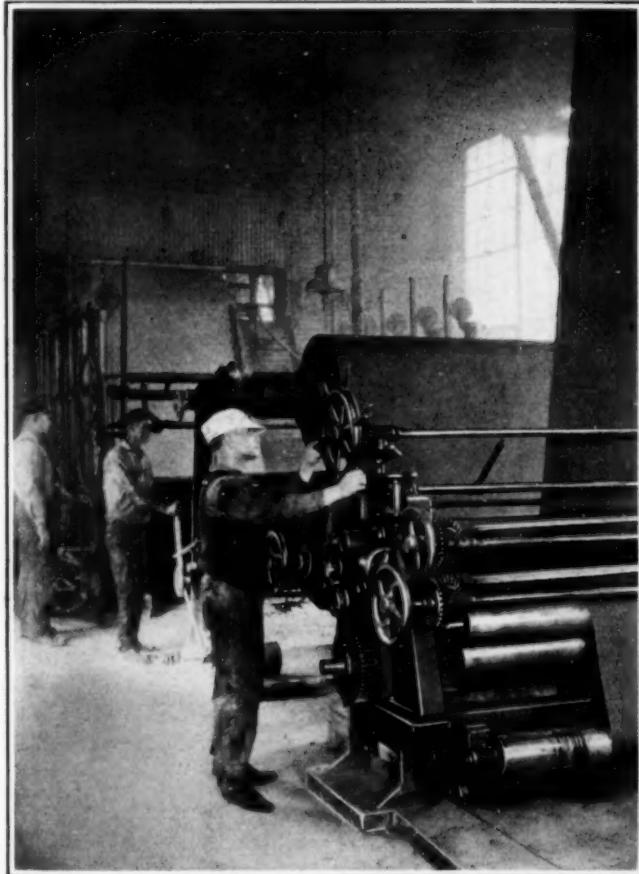
It is interesting to observe briefly the laboratory tests made on each piece of linoleum to determine if it is hard enough to withstand service on the floor. One of the principal tests is made by allowing the flat end of a steel rod 0.282 in. in diameter carrying a load of 80 lb. to rest on the goods for one minute. If the surface of the goods does not break or show even a hair-line crack around the imprint of the rod and if the tested spot returns to within 0.01 in. of its original thickness within an hour after the weight is removed, the goods are considered hard enough for service on the floor.

PRINTING FELT-BASE FLOOR COVERINGS

A newer type of product that has increased in popularity as better production methods have improved its wearing qualities and appearance, is the printed felt base floor covering. The felt base for these goods is a rag felt, similar to that used as a basis for asphalt roofing.¹

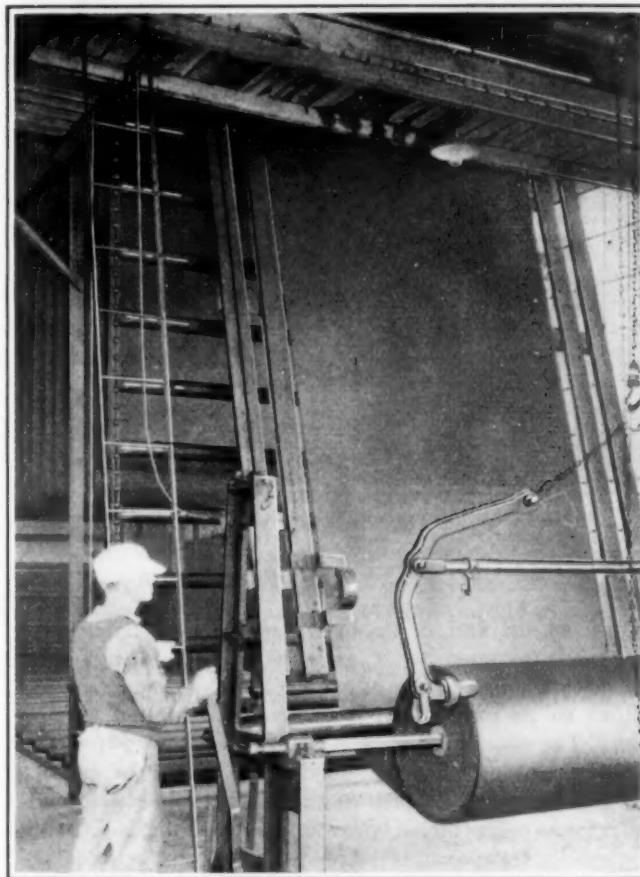
The first step in the manufacturing process is to saturate the felt by drawing it slowly through a bath of asphalt saturant at a temperature of about 450 deg. F. As the felt comes from this bath it passes between two heavy steam-heated squeeze rolls that press

¹One of the plants of the Certain-teed Products Corporation making rag felts was described by A. W. Allen, in an article in Chem. & Met. Jan. 14, 1924.



Making Felt Base Flooring

In background are the squeeze rolls for pressing the excess saturant out of the felt, while the back coating mill is shown in the foreground



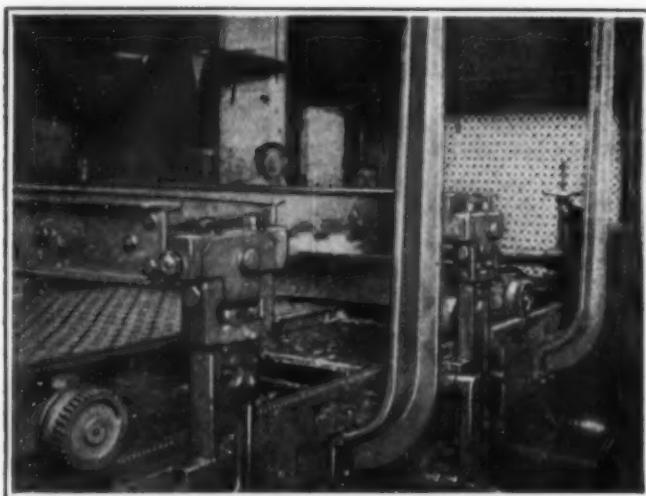
Continuous Looper for Rag Felt

This machine festoons the rag felt after it has been saturated with asphalt and prior to its delivery to the face coating mill

out the excess saturant. The felt is then rewound on 2-bolt reels. As one reel is being filled the saturated felt from the other passes through a rotary coating mill, where a coat of an extremely fast-drying red paint is applied to the back of the sheet. This is done in order to improve its appearance, also to prevent the asphalt in the felt from spoiling the face of the goods when it is rolled for shipment. The coated goods is run into loops in a looping machine, and after it has cooled and the paint has hardened, it is again wound into large rolls.

The saturated—or backed-felt as it is called—is given a coat of fast-drying red paint on its face. When this facing coat is dry a coat of gray paint is applied over it and the felt is run into the drying room where it is held over night at a temperature of about 140 deg. F. The two coats of facing paint must meet several exacting requirements. The first facing partially seals the asphalt saturation and must dry to a reasonably flexible film. The second facing must completely seal in the asphalt so that it will not bleed through and discolor the light-colored finished enamels even during the week of curing at 140 deg. F. Furthermore it must dry overnight to give a suitable printing surface flexible enough so that it will not crack in the printing heaters and yet hard enough to form a basis for finishing coats.

From the heaters the goods are taken to the printing department where special presses print a design on the faced felt. These machines are 40 to 50 ft. in length and of various widths to handle goods from 6 to 12 ft. wide. The coated felt is carried mechanically over the flat bed of the press and under 10 to 15 "heads" that extend across the bed at 3-ft. intervals. These heads



Putting the Pattern on Felt Base Floor Covering
This view shows the felt base floor covering with its pattern printed on, leaving the printing machine for the drying and curing rooms

are moved up and down by large cams. Under each head and fastened to it is a wooden printing block 18 in. wide on the face of which is cut the part of the pattern to be printed with the colors supplied to that block. The machine is synchronized so that as the head lifts the block from the goods, the latter is carried forward exactly the width of the head. When the heads are raised, color boxes move under them and a roller turning in the paint contained in the box applies the proper amount of color to the surface of each block. The heads are spaced on 18-in. centers; thus a given 18-in. length of goods will be under a head and receive an impression on alternate motions of the machine. As in the case of the presses used for color printing on paper, the blocks are so cut and accurately set on the heads that the pattern applied by each block fits exactly into its proper position in the design and leaves no uncovered spaces or overlapping of colors.

The enamel paints used for printing must flow out level over the goods, yet must not run together even when the freshly painted goods are drawn vertically from the machines to heaters on the fourth floor of the building. The paints used in printing the outlines and overlays must "stay put" even when printed directly on top of freshly applied ground colors. And, of course, when dried on the finished goods the prints must be smooth and glossy as well as hard and tough enough to resist wear on the floor.

The printed goods from the machine are trimmed to desired width and cut into pieces 90 ft. in length, which are laid flat on individual shelves in a heater unit and after about 100 pieces are placed in the unit, it is closed and the temperature brought up to 140 deg. F. After drying for nearly a week at this temperature the paint film is sufficiently hard and the goods are pulled from the heaters. Each piece is inspected, crated and shipped.

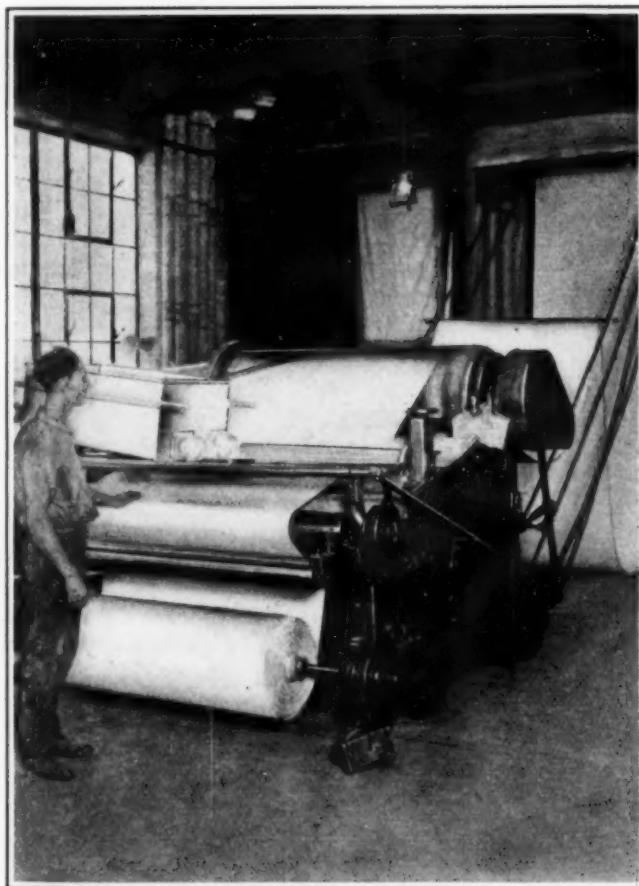
MAKING OIL CLOTHS

Table oil cloths of several varieties are made at the Philadelphia plant. The base of these goods is cotton sheeting which must be calendered and given several sizing coats in order to close up the meshes and furnish a smooth surface for the application of succeeding coats. The sizing liquid is an emulsion of linseed oil and casein solution to which china clay has been added

as a filler and to give the necessary body. The size coats are applied on coating drums, the sizing liquid is poured onto the cloth as it passes under a knife or scraper that controls the amount of material thus spread over the surface of the sheet. The coated cloth passes directly around a 16-ft. steam-heated drum which drives off most of the water in the coating before the goods are rewound on rolls.

After receiving the sizing coats the goods are run into festoons in the drying room and dried overnight at 150 deg. F. The following morning they are calendered and given an "undercoat" on a knife type coating mill and are again dried overnight. This undercoat is either white or yellow depending upon whether the cloth is to be used for making white oil cloth or the mosaic printed varieties.

After the undercoating is dry the goods are again calendered and the cloth with the yellow undercoat is printed with a design in a single color. This is done by running the cloth over a cylindrical copper shell which has had a pattern engraved on its surface. The shell is "inked" with dry colors ground in a thin, fast drying varnish. The printed goods are dried and given a coat of clear varnish on a knife-type coating mill. From the final drying room the goods are inspected, wound into 12-yd. bolts and packed for shipment. The cloth with the white undercoat is finished in a like manner with a white enamel. After drying overnight it is inspected and wound into bolts for shipment. Some of the white goods are printed with a marble pattern by the same operation and equipment for making the mosaic oil cloth.



Knife Type Coating Machine for Oil Cloth
This machine is used for putting on the undercoat, that is, the first coat of enamel upon which the decorative coats are later superimposed

To make linoleum, floor coverings and oil cloth, the Certain-teed plant at Philadelphia draws its materials from all over the world. The burlap is woven in Scotland of jute raised in India. Cork is imported from Portugal. The linseed oil is crushed in this country from Argentine, Canadian and domestic linseed. Varnish gums come from New Zealand and the East Indies. The wide variety of pigments and dry colors are collected from Spain, France, England, Cyprus, Belgium and Germany in addition to those supplied from domestic sources. The floor covering felt is made from rags collected in the United States and Europe. It is thus apparent that linoleum, like so many other products of modern industry is one of international interest.

For permission to visit the plant of the Certain-teed Products Corporation, we are indebted to its Vice President, Mr. A. Whittemore, and to Mr. Rollin C. Gere, the Manager at Philadelphia. For much of the information contained in this article, acknowledgment is made to the chemical and engineering staffs and particularly to Mr. John E. Pyron, plant chemist.

Electrolytic Refining of Aluminum

Producing Aluminum of High Purity by Electrolysis With a Fused Salt Electrolyte in the Hoopes Cell

By Francis C. Frary

Director of Research, Aluminum Company of America

A PRACTICAL* method of refining impure aluminum, in order to produce aluminum of high purity, has long been desired. Since metallic aluminum cannot be deposited by the electrolysis of any aqueous solution, and the high cost and low electrical conductivity of organic solvents render their use impractical, it would appear that the only practical solution of the problem of electrolytically refining aluminum lay in the use of a fused salt electrolyte. This was first proposed about 1900 by William Hoopes, and his proposal was then tried out in modified form and on a small scale by Charles M. Hall, using the arrangement shown in Hoopes' U. S. Patent No. 673,364, dated April 30, 1901. Mr. Hoopes' original proposition, however, as made to Mr. Hall, was to use a refining cell in which a molten aluminum cathode would float on an electrolyte heavier than the molten aluminum, instead of on cryolite, which is lighter than aluminum; the anode alloy was to be still heavier than the electrolyte, and would lie on the bottom of the cell. Such an arrangement was later proposed independently by Betts. However, the practical difficulties involved in the construction and successful operation of such a cell were not solved at that time, nor do they appear to have been later solved by Betts or other early workers. A recent patent of Tucker revives the proposal of using a cryolite bath, leaving both anode and cathode layers on the bottom of the cell, but separated and insulated by a wall of frozen bath. The irregular current distribution and the concentration of power (and heat) at the surface of the dividing wall, would make it impossible, the author believes, to keep such a cell in practical operation for any length of time.

The voltage requirement would also be much larger than with a cell of the three-liquid-layer type, where the anode and cathode surfaces are parallel and may be only a few inches apart over their whole area.

Several years ago the research bureau of the Aluminum Company of America, under the supervision of Mr. Hoopes as head of the technical department, and with his close personal co-operation, undertook to develop a commercial cell and process for the electrolytic refining of aluminum. While the writer and many other members of the research and operating staffs of the company (especially D. H. Tilson, J. D. Edwards, and B. T. Horsfield, of the research bureau, and J. E. S. Thorpe and R. E. Parkes, of the operating department of the Aluminum Company of America) have contributed to the solution of the problem, the main credit must go to Mr. Hoopes, whose unfaltering faith and high inventive ability enabled him not only to lay down many of the basic principles upon which the successful solution rests, and to point out many of the important details in this solution, but also to appreciate and utilize to the fullest extent the criticisms and suggestions of all who were engaged in the work. It is indeed a tragedy that he did not live to enjoy the public appreciation of his success in the solution of this difficult problem.

EXPERIMENTS BY BETTS

In Betts' cell connection to the cathode metal is supposed to be made through partially liquid metal. The bath preferred was cryolite saturated with alumina, or a mixture of cryolite and barium chloride. The anode might be aluminum alloyed with iron, copper, zinc, or other heavy metals, and might be either liquid or solid.

Unfortunately, experiment shows that the addition of alumina to cryolite reduces its specific gravity in the molten state, instead of increasing it, so molten aluminum would not float on such a bath. Also, barium chloride has been proved to be poorly adapted as an addition agent for many reasons, especially because the presence of a chloride causes large loss by volatilization, and also weakens the selective activity of the bath, so that too much iron and silicon are dissolved from the anode and carried over to the cathode. The proposed current connection to the molten cathode is also impractical for a number of reasons.

In order to produce a cell which could operate continuously at a good current efficiency, it was absolutely essential to guard against partial short circuits between anode and cathode through the hot lining. This Mr. Hoopes accomplished by dividing the cell horizontally into two electrically insulated sections, and water-cooling the joint between them as shown in the accompanying illustration. The lower half of the cell contains the carbon bottom lining, in which rests the molten anode alloy *A*. Upon this is superimposed the molten bath layer *B*, and upon this floats the molten aluminum cathode *C*.

The bath is composed of a mixture of cryolite, aluminum fluoride and barium fluoride, nearly saturated with alumina. By virtue of the cooling effect of the side walls of the cell, there is built up on these walls by a process of selective crystallization, a thick crust very rich in alumina, which is very refractory and not easily dissolved away by the bath, if for any reason the temperature of the cell rises above normal. This crust serves to insulate, electrically and thermally, the molten bath from the shell; it also minimizes the leak-

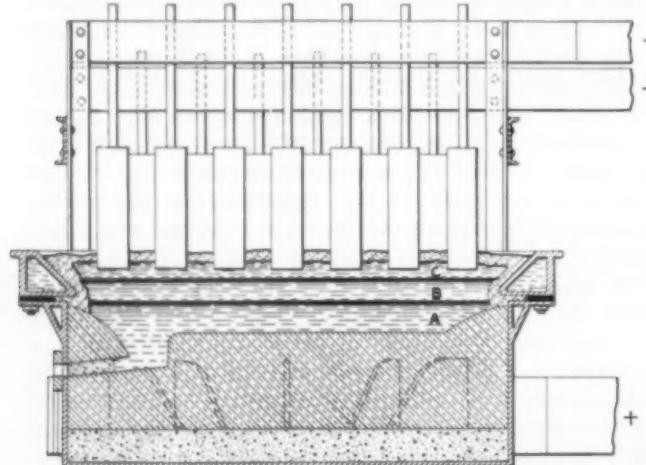
*Paper presented before the General Meeting of the American Electrochemical Society, Niagara Falls, N. Y., April 23 to 25, 1925.

age of current from anode to cathode through the walls. It is very important, in starting up such a cell, to make sure that the upper half is maintained in an electrically neutral condition, in order to prevent the formation of a side crust partially contaminated with metal. Such a crust seems to conduct enough current to cause electrolysis to take place in it, and its content of metal gradually increases until its conductivity becomes prohibitively high.

In order to make the electrical connection to the molten cathode, it was found necessary to use graphite electrodes dipping into the floating aluminum layer. These are carried on heavy copper rods, as shown in the figure. It was also found that under proper conditions a crust of frozen bath, rich in alumina, would form over the upper surface of the metal, and around the electrodes, and act as a protective cover. Care must be taken to maintain an adequate metal thickness in the cathode layer; otherwise the heavy currents and powerful magnetic fields set up a swirling motion so violent that the anode and cathode layers can come into contact in spots. This, of course, results in their union and the loss of the refined metal.

There seems to be only one practical anode for such a cell. This is a copper-aluminum alloy, low in iron and titanium (which raise its freezing point) and preferably containing enough silicon to lower its freezing point considerably, so that it will remain adequately mobile even when the aluminum content has been largely reduced. The proper working temperature of the cell is limited by the properties of the fused electrolyte, and lies between about 900 and 1,100 deg. C. In the nature of things, the anode alloy tends to be cooler than the electrolyte. If any appreciable amount of it freezes, copper and other impurities will be dissolved from the frozen portions by the current, and the refined metal will be contaminated.

The cell is easily started by pouring into it a layer of molten bath several inches thick, lowering the graphite connectors to dip into the bath layer, and turning on full load current. A layer of molten anode alloy is then slowly poured in, taking care that the joint between the upper and lower halves of the cell is covered only by the bath. A layer of molten aluminum carefully poured onto the surface of the bath, followed by a final adjustment of the graphite connectors, completes the operation, and if the bath is of proper composition the alumina-rich side crust and top crust will soon begin



Hoopes Cell for Electrolytic Refining of Aluminum
In the lower half of the cell, at A, is the molten anode alloy. Upon this is superimposed the molten bath B, while at C is the molten aluminum cathode, floating on the bath

to form, and in a few hours the cell is in normal operation.

In order to keep the cell operating, the aluminum produced at the cathode must be tapped off, and a corresponding amount of impure aluminum or aluminum-copper alloy added to the anode. If the cell is being used to refine impure aluminum, this operation may be carried out simply in two steps. The necessary amount of the molten impure aluminum is poured into a suitable crucible, which is placed in a hole in the floor in front of the anode-alloy tap hole. The current is then cut off, the tap hole opened, and a few hundred pounds of the impoverished anode alloy tapped into the crucible of molten aluminum, so as to produce an alloy heavier than the molten bath. This alloy is then poured back into the cell through a suitable carbon-lined funnel, extending into the anode alloy layer. As the level of the molten mass in the cell rises, the tapping trough in the top section is opened, and the pure cathode metal is allowed to flow out into another crucible, the amount obtained being, of course, approximately the same as that of the new aluminum added.

The cells operate with an excellent current efficiency, on from about 5 to 7 volts and about 20,000 amperes, and require little attention except at tapping time. A certain amount of sodium is produced at the cathode, and together with some of the aluminum, is gradually oxidized. This results in a gradual thickening of the side crust, and from time to time the excess of alumina is removed by digging out some of this side crust and adding fresh electrolyte. The cells have been operated continuously for months at a time under works conditions, and it has been shown to be entirely practical thus to produce any desired amount of metal with an average purity of over 99.80 per cent. In fact, much of the metal will be 99.90 per cent pure. The grade commercially offered, however, is guaranteed 99.80 per cent. The highest purity we have yet obtained by electrolytic refining was 99.983 per cent. The principal impurity is usually copper, the iron and silicon being present in very small amounts only. This high purity greatly increases the resistance of the metal to chemical reagents.

Recent Developments in French Bauxite

Bauxite deposits in southern France are expected to take on a considerable development in the near future by reason of new uses for the mineral. The growth of the aluminous cement industry is one of these; 2 important French companies and a newly installed British company in France being engaged in making this cement. Aluminum metal and wire is being used more than ever in electrical industries. Large quantities of bauxite ore are still being exported to Holland and Germany, and to the United States in lesser quantities, through the Mediterranean port of Toulon.

It is proposed further to make a more extensive use of powdered bauxite for the decolorization of mineral and other oil products. Oil filters of various forms are daily making use of this product which a few years ago was entirely unknown.

Italy is also developing recently exploited bauxite deposits. French deposits of bauxite mineral are estimated at 60,000,000 metric tons, running from 55 to 60 per cent of pure alumina. French production of aluminum metal in 1923 was 17,000 metric tons, out of a world production of 64,800 metric tons.



Woburn Works of the Merrimac Chemical Company, South Wilmington, Mass.

New Method of Concentration Cuts Cost of Making Sulphuric Acid

How the Stantial Divided Glover Tower Makes Possible Simultaneous Production of Strong Acid and Denitrated Gay-Lussac Tower Acid by Utilizing Waste Heat from the Sulphur Burners

By Chaplin Tyler

Assistant Editor, *Chem. & Met.*

CUTTING the over-all cost of making strong sulphuric acid at least 10 per cent is the accomplishment of the Stantial divided Glover tower that has been operated successfully in 2 plants of the Merrimac Chemical Company of Boston, Mass., since 1923. In the Stantial invention, hot gases from the sulphur-combustion chamber pass direct into the base of the tower, which is partitioned vertically into 2 shafts that are operated in parallel. One shaft of the tower produces strong acid from 63 to 66 deg. Bé., and the other shaft yields weaker denitrated acid, 58 to 60 deg. Bé., for distribution to the Gay-Lussac tower.

The essentially new features of operation of the Stantial tower, as compared with other concentrating Glover towers are (1) the simultaneous production of strong acid and of weaker Gay-Lussac tower acid, by means of a divided tower operated in parallel; (2) the direct production of Gay-Lussac tower acid of the correct strength and without any subsequent dilution, and (3) the production of 63 to 66 deg. Bé. acid without using heat other than that from the sulphur burners.

Stimulus for the development of the divided Glover tower was found in the economic situation confronting nearly every manufacturer of sulphuric acid. Recent trends in the buying habits of chemical industry show that the demand for 66 deg. Bé. acid is increasing rapidly and out of proportion to that for the weaker grades. This has made necessary the construction of either contact-process plants, or of special concentrators, not because of increase in business, but simply to make stronger acid. In fact, the Merrimac Chemical Company had nearly decided to authorize an additional

contact-process unit, although some of the chamber plants had long been idle, when the merits of the Stantial divided Glover tower became apparent through the completion of much painstaking engineering development.

In the operation of an ordinary chamber-process set, there may be produced in the Glover tower niter-free acid of about 58 to 60 deg. Bé., only part of which is required to supply the Gay-Lussac tower. The remainder of the acid is withdrawn from the system and is sometimes concentrated further, to 66 deg. Bé. Concentration can be effected in separate equipment, such as in cascade systems or in packed towers, heat being supplied by the combustion of coal or fuel oil. However, these methods are inherently wasteful when 66 deg. Bé. acid is to be made, as the heat from the sulphur-burner gases is greatly in excess of that necessary to operate the Glover tower in the ordinary manner, and this has resulted in various attempts to utilize this excess for the further concentration of the acid in the Glover tower itself. Previous methods of Glover-tower concentration have proved inefficient, as about two-thirds of the acid so concentrated has to be diluted with water in order that it may be sufficiently weak to be denitrated after passing through the Gay-Lussac tower. The diluting water must, of course, be distilled into the chambers, thereby making undesirably weak acid, and at the same time largely nullifying the intended object of concentration.

In the Stantial Glover tower, a mixture of Gay-Lussac tower acid, chamber acid and any necessary water is distributed between two shafts of the Glover tower, the acid in one shaft being denitrated and concentrated to

the proper gravity, 58 to 60 deg. Bé., for use in the Gay-Lussac tower, the acid in the other shaft being denitrated and concentrated as much as possible, 63 to 66 deg. Bé., and is withdrawn from the system, either as finished product, or for use in the contact-process plant.

Denitration and concentration is accomplished by feeding acid and sulphur-burner gases in parallel to the two shafts, the degree of concentration in each shaft being controlled by proper division of the feed, and of the burner gas. Thus, the quantity of acid necessary for operating the Gay-Lussac tower is fed into one shaft where it is denitrated and concentrated to 58 to 60 deg. Bé., and the remainder is fed to the other shaft where it is denitrated and then concentrated as much as desired. In this way, dilution with a large quantity of water is avoided, and all of the available heat from the sulphur burners does useful work.

Reference to Fig. 2 will indicate the basic features of design of the divided Glover tower. It will be seen that the Stantial tower differs from the conventional Glover tower in two fundamental respects: (1) the tower is partitioned vertically, the only connection between the two shafts being an orifice near the floor for the passage of burner gases and (2) provision is made for by-passing the oxides of nitrogen from the niter pots around the tower. The shaft nearest the combustion chamber is known as the "concentrating tower" and the far shaft is known as the "system" tower.

Heat is conserved in two ways: the flue connecting the combustion chamber is close-coupled to the base of the concentrating tower, and the sulphur burner, combustion chamber and flues are covered with heat insulation. By sloping the flue downward into the base of the concentrating tower, the hot gases from the combustion chamber are deflected onto the surface of the acid, which at all times covers the floor, thus lessening the destructive effect of the gases upon the brick work, and at the same time promoting more efficient evaporation.

Both shafts of the tower are packed with volvic lava brick similar in design to any good packing having a

large amount of surface for evaporation, and that allows a uniform flow of gas and liquid. A rectangular channeled shape has proved satisfactory. The lining and partition walls should be built solid with a suitable cement such as "Duro," to prevent the leakage of niter-bearing acid past the denitrating zone, with consequent dilution and contamination of the denitrated acid, especially on the concentrating side of the tower. Other essential features of construction are the control dampers in the gas-discharge conduits at the top of each tower, and the mixing box, which is placed above the acid-distributor head. The thickness and extent of heat insulation depends upon the work being done, and if necessary, 75 to 80 per cent of the heat of combustion of the sulphur can be utilized in the tower.

In operation, assuming the requirements of the Gay-Lussac tower to be about equal to the "make" of the chambers, the acid from the concentrating tower will be about 66 deg. Bé., starting with chamber acid of 54 deg. Bé., and feeding acid of approximately 59 deg. Bé. to the Gay-Lussac tower. If one-half of the mixture of Gay-Lussac tower acid and chamber acid is fed to the system tower, and one-half to the concentrating tower, approximately equal volumes of burner gas will be required by each shaft, regulation of gas being effected by means of dampers. The exact ratio of gas flow, and of acid flow in the two shafts must, however, be determined experimentally on the full-sized plant, and this ratio will, of course, vary with the entrance temperature of the burner gas. If the gas entering the concentrating tower is approximately 1,000 deg. C., the temperature at the base of the system tower will be about 500 deg. C., and at the top of both towers, the gas will have cooled to 100 deg. C. Equalization of the exit gas temperatures can be effected by varying the depth of tower packing. The sudden drop in gas temperature in passing the short distance from the base of one shaft to the other is caused by the efficient transfer of heat to the acid in the base of the concentrating tower. In entering, the burner gas first impinges on the layer of acid covering the floor of the shaft, and is then deflected upward.

FIG. 2—SCHEME OF THE STANTIAL DIVIDED GLOVER TOWER—Hot gases from the sulphur-combustion chamber pass direct into the base of the "concentrating" tower, where rapid cooling to about 480 deg. C. occurs. It is here that final concentration of the product takes place. About one-half of the volume of gas is ordinarily fed to each tower. Regulation of gas flow is effected by dampers in the exit flues at the top of the tower.

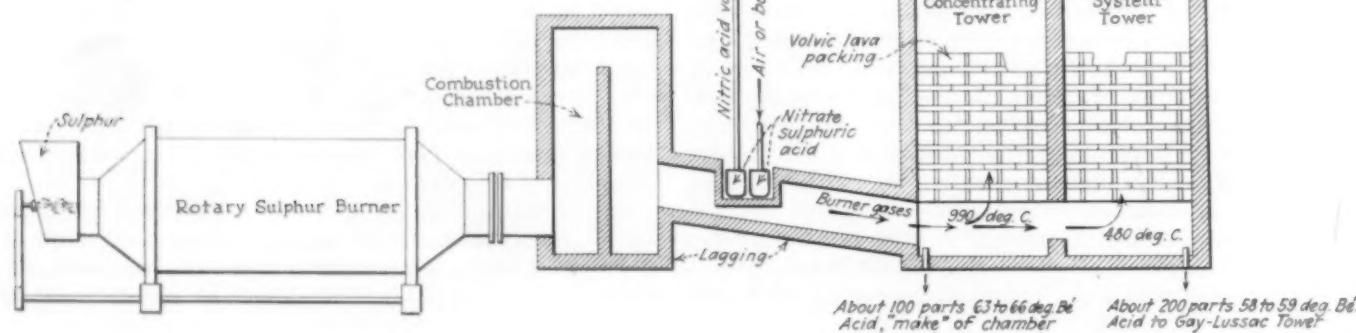


Table I—Approximate Heat Balance on Stantial Divided Glover Tower.
When Burners Use 20,000 Lb. Sulphur Per Day

	System Tower, B.t.u.	Concentrating Tower, B.t.u.	Total Heat, B.t.u.
Heating acid 50 deg. F. below B.P.	8,100,000	9,500,000	17,600,000
Heating acid in 48 deg. Bé to 212 deg. F.		200,000	200,000
Dehydrating acid	720,000	7,500,000	8,220,000
Heating water in acid	580,000	2,600,000	3,180,000
Heating water in 48 deg. Bé acid		300,000	300,000
Evaporating water in acid	4,100,000	19,200,000	23,300,000
Evaporating water in 48 deg. Bé acid		2,000,000	2,000,000
Heating N_2 , O_2 , SO_2	3,000,000	3,000,000	6,000,000
Total	16,500,000	44,300,000	60,800,000
Thermal efficiency	$\frac{60,800,000}{83,000,000} = 73$ per cent		

Most important, however, is the shower of acid from the packing arches that make rapid heat transfer possible. As a result, the brickwork of the tower is remarkably well protected, making it possible to use acid-proof cement in building the walls.

UNIFORM DISTRIBUTION OF ACID ESSENTIAL

Efficient denitration of the concentrating tower acid depends very largely upon proper distribution of the acid over the top of the packing. Ordinarily, no difficulty should be experienced with any good filling, unless it has been packed carelessly, allowing channeling of the gas and liquid. A Glover tower actually has to do the work of a denitrating column and concentrating column, and under adverse conditions, hence the necessity of care in design and construction. The principal conditions necessary for success when concentrating acid in divided towers are:

(1) The tower will use 71 to 82 per cent of the heat of combustion of the sulphur for denitration and concentration if the Gay-Lussac tower requires 100 per cent of the output of the chambers at 58 deg. Bé., and if the chamber acid is 54 deg. Bé. Insufficient heat will result in weak acid, or less output of strong acid.

(2) Denitration and reconcentration in the system tower must be efficient, otherwise there will be insufficient heat for the concentrating tower.

(3) The Gay-Lussac tower acid should be used as weak as possible, in order that the chamber effluent may be run as strong as possible, thus making the net quantity of heat for 66 deg. Bé. concentration and dehydration as small as possible.

(4) Reduction of the entering gas temperature should be as rapid as possible to lessen destruction of the brickwork. This necessitates a fine state of division of the liquid as it falls from the arches of the tower.

(5) Distribution of the acid over the packing should

be as complete and uniform as possible. This can be effected by a multiplicity of open distributors that can easily be adjusted for flow and that do not clog.

(6) All brickwork should be laid with a cement such as "Duro" to prevent contamination and dilution of the denitrated acid by percolation of acid from above.

(7) The exit gas from the towers should be as cool as possible.

(8) All the water vapor from the Glover tower must be used in the front chambers of the set, without making acid that is too weak, and without disturbing the water-balance of the chambers. If the acid is concentrated to 63 deg. Bé., the first quarter of the chamber capacity will be needed to absorb this vapor; when concentrating to 66 deg. Bé., the first third of the capacity will be needed.

A heat balance on a plant burning 20,000 lb. of sulphur per day shows that about 25 per cent of the heat used in the tower is absorbed by the system tower and 75 per cent is absorbed by the concentrating tower. In this example, chamber acid enters the mixing box of the Glover tower at 54 deg. Bé., the concentrating tower output is 66 deg. Bé., and 6 per cent of the plant output is weak 48 deg. Bé. acid returned to the chambers with the gases from the Glover, and 100 per cent of the "make" is used on the Gay-Lussac towers. The heat of combustion of the sulphur plus the heat of formation in the tower of 10 per cent of the "make," is about 83,000,000 B.t.u. per day, of which 73 per cent is utilized according to the analysis shown in Table I.

Assuming heat losses from the Glover tower to be 16 per cent and those from the burners, combustion chamber and flues another 10 per cent, there is still a small margin in excess of that necessary to do work in the tower. With improved equipment, specially designed to reduce heat losses to a minimum, there is reason to expect a thermal efficiency of at least 80 per cent. However, if this extra heat is not needed in the tower, some precooling of the burner gas is desirable, otherwise the exit gases from the tower will be too

Table II—Production of 66 Deg. Bé. Sulphuric Acid in Contact Units

Assume: 10,000 lb. of sulphur burned in 24 hr. at 100 per cent efficiency.						
(a) Total output of plant is 66 deg. acid when SO_2 gas is dried with sulphuric, 63 deg. Bé. or stronger, which is strengthened with SO_3 in the contact apparatus.						
Temperature of Gas		Deg. Bé. of Dilution Acid				
Going to Drying	Towers, Deg. C.	Water	60	63	64	65
25.4		32,900	62,830	83,830	101,530	150,330
30.0		32,900	60,340	79,460	95,460	140,160
34.4		32,900	56,900	73,700	87,800	126,900
40.0		32,900	52,000	65,300	76,500	107,500
Lb. of 66 Acid						
Output						

(b) SO_2 gas dried with 63 deg. acid that is then used for chamber acid purposes. This makes output of 66 deg. acid in contact apparatus independent of temperature of gas entering drying towers.

Deg. Bé.	Acid Used to Dilute		Total Weight of 66 Deg. Output, Lb.
	Weight, Lb.	Water	
water			32,900
63	74,500		99,500
64	99,100		124,100
65	161,000		186,000

Table III—Production of 25 per Cent Oleum in Contact Units

Assume: 10,000 lb. of sulphur burned in 24 hr. at 100 per cent efficiency.						
(a) Total output of plant when SO_2 gas is dried with sulphuric acid, 63 deg. Bé. or stronger, which is strengthened with SO_3 in the contact apparatus.						
Temperature of Gas		Deg. Bé. of Dilution Acid				
Going to Drying	Towers, Deg. C.	Water	60	63	64	65
25.6		34,954	37,024	38,194	40,224	Lb. of
30.0		33,490	35,070	35,950	37,470	25 Per Cent
34.4		31,673	32,620	33,150	34,060	Oleum
40.0		29,000	29,000	29,000	29,000	Output

(b) SO_2 gas dried with 63 deg. Bé. acid which is then used for chamber acid purposes.

Deg. Bé. of Dilution Acid	Lb. 25 per Cent Oleum Output
Water	28,900
63	43,950
64	46,100
65	49,450
66	59,000

Table IV—Chamber Plant Capacity Needed to Keep Contact Units in Operation

Assume: 10,000 lb. of sulphur burned in contact plant at 100 per cent efficiency. All drying to be carried out with 64 deg. Bé. H_2SO_4 from a Stantial Glover tower and which is diluted by the water vapor in the gas to 56 deg. Bé. and is used for chamber acid purposes.

(a) Total output of contact plant as 25 per cent oleum = 46,000 lb.

Temperature of Gas Entering Drying Towers, Deg. C.	Lb. of Sulphur Equivalent to Dry Gas	To 64 Deg. Acid Used	To 64 Deg. Acid Used to Dilute SO_2	Total Lb. Sulphur in Chamber	56 Deg. Bé. Acid Produced When Drying the SO_2 Gas, Lb.
25.6	2,535	+	5,890	=	8,425
30.0	3,240	+	5,890	=	9,130
34.4	4,140	+	5,890	=	10,030
40.0	5,500	+	5,890	=	11,390

(b) Same as above, but total output of contact as 66 deg. Bé. acid = 124,100 lb.

25.6	2,535	+	27,700	=	30,235
30.0	3,240	+	27,700	=	30,940
34.4	4,140	+	27,700	=	31,840
40.0	5,500	+	27,700	=	33,200

(c) All drying acid produced in the contact plant and used for diluting the SO_2 to 25 per cent oleum.

Lb. of sulphur equivalent to acid required for dilution when all the 56 deg. Bé. drying acid is used for dilution.

Strength of acid, deg. Bé.	60	62	64	65	66
25.6	2,010	2,420	3,110	3,780	5,450
30.0	1,556	1,880	2,440	2,900	4,180
34.4	1,000	1,250	1,580	1,900	2,720
40.0	0	0	0	0	0

hot, thus necessitating a higher tower or the use of more acid on the Gay-Lussac.

APPRECIABLE SAVINGS POSSIBLE

The relation of the divided Glover tower to the production cost of 66 deg. Bé. acid can be studied on two separate bases, depending upon whether or not contact-process units are operated in series with chamber-process units.

Assume, in the first example, a chamber-process plant operating independently, and equipped with the usual form of Glover tower. Assume further that 58 to 60 deg. Bé. chamber acid is to be concentrated by one of the modern methods (see *Trans. Am. Inst. Chem. Eng.*, 1921-22, vol. 14, pp. 13 to 25.), such as the cascade, combined cascade and tower, tower, combined surface evaporation and tower, or hot-air submergence systems. Allowing for recent changes in the price of fuel oil, the cost of concentrating 58 to 60 deg. Bé. acid to 66 deg. Bé. will be from \$1.50 to \$4 per ton, depending upon the method used and the capacity.

The substitution of a divided Glover tower adequate for the production of 66 deg. Bé. acid involves a proportionately small amount of invested capital, and adds nothing to the expenses of operation, such as maintenance, labor and fuel. Hence it is fair to say that this form of tower will save in any given instance, almost the entire cost of concentration by any other system. Ordinarily this saving in the over-all cost of production of 66 deg. Bé. acid will be from \$1.50 to \$2.00 per ton of product.

When the chamber-process plant is operated in series with a contact-process plant, the problem from an economic standpoint, is not as simple as before. In this example, the total production cost of 66 deg. Bé. acid, or of 25 per cent oleum as the case may be, can be divided into 2 distinct parts: the chamber-plant cost, and the contact-plant cost. As before, there will be a definite saving in the chamber-plant cost, and this will be proportional to the concentration of the 63 to 66 deg. Bé. acid delivered to the contact plant. Feeding 65 deg. Bé. acid to the contact plant instead of 60 deg. Bé. acid will about double the capacity of a contact unit, making a 66 deg. Bé. product, and without increasing appreciably the manufacturing overhead, which in this

type of plant, is a large item. Tables II, III and IV show the quantitative relationship between contact plant capacity and the concentration of feed supplied by the chamber plant.

Other significant economic phases of the Stantial divided Glover tower are: greater flexibility in combined operation with contact units; the ratio of chamber or tower process units may be varied and for a given production of 66 deg. Bé. acid or of oleum, using the processes in series, a smaller amount of invested capital need be "frozen" in plant equipment, and already existing chambers, at comparatively small cost, can be enabled to produce strong acid.

Chemical Industry in the Paris Area

As elsewhere in France, the chemical industries have taken on a great development in the Paris district since the war. Notably the production of sulphuric acid plays an important rôle—soda, hydrochloric acid, nitric, dyestuffs and other coloring materials also are in ascendancy, and superphosphates to a less degree.

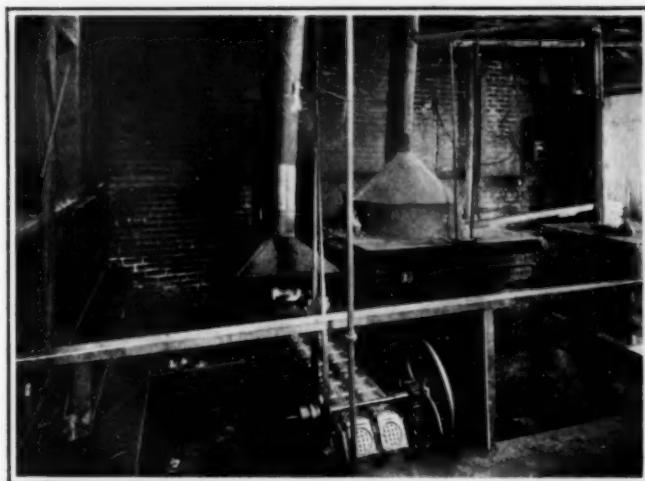
Pharmaceutical products are made by 20 plants in the district, many of the "specialties" being known throughout the entire world. Associated as it is with the very word luxury, Paris fills an important niche in the perfumery industry, of which the raw and semi-raw materials are drawn from distilleries near the famous flower fields of southern France. Perfumeries, lotions, powders and toilet accessories are distinctly and more largely of Paris production than elsewhere in France. Coloring matters, notably paints, dyes and inks and their similar products, waxes, gelatines and celluloid also occupy an important place.

Marseilles a Chemical Center

In spite of the decentralization of many of the major French industries, Marseilles, the greatest of Mediterranean seaports, holds pre-eminence as the chief of chemical production and distribution. This progress began to be noted only about 1850, although for generations it had led with respect to the production of edible and industrial oils.

The development of the use of superphosphates, due to the comparatively new phosphate deposits of Algeria and Tunisia, and latterly of Morocco, has given a spurt to the chemical industries which was unknown in times past. It may be said that during the war when various plants in the north had fallen into the hands of the enemy, it was found desirable to develop to a still higher degree this Marseilles district. The entire suburban region within the city limits and to the west to Port de Bouc and the Etang de Caronte, has been built up with plants devoted to this important industry. A large volume of the raw material is, however, transshipped to other important plants in the valley of the Rhone between Avignon and Lyons, but Marseilles remains the gateway.

The Marseilles industry proper employs about 7,000 workers distributed in 30 individual plants. The industry in its various phases is varied, running from the heavy chemical industries to plants producing colors, varnishes and derivatives of arsenic and zinc white and for export Marseilles is the naturally indicated port.



Casting lead "buckles." Lead for this purpose is free from silver, antimony, bismuth and copper



Cast-lead buckles in storage prior to being stacked in the corrosion pots

Manufacture of White Lead by the Old Dutch or Stack Process

By W. R. Waelty

Chief Chemist, W. P. Fuller & Co., San Francisco

Historical Review and Modern Technology of a Method than Can boast a Record of 22 Centuries Operation

THE white lead of commerce is composed of 69 per cent lead carbonate and 31 per cent lead hydroxide, forming a basic carbonate of lead having the formula $2\text{PbCO}_3\text{Pb}(\text{OH})_2$. Several processes are available, the oldest and best known of which, the Old Dutch or Stack process, still produces much of the white lead made in this country.

The first mention of white lead is made by Theophrastus in a book written about 300 B.C. In this he describes a process in which lead was placed with vinegar in earthenware pots, which were allowed to stand in the sun. After adequate exposure a white powder could be scraped from the lead. The product was probably mostly lead acetate, with smaller, varying amounts of lead carbonate.

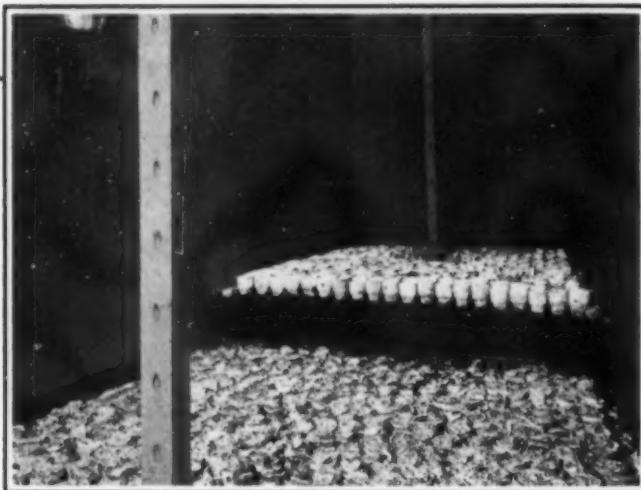
No mention was made then, or in the histories of the next few centuries, of a source of carbon dioxide. It is doubtful if it was known that the gas played a part in the reaction, although it is easy to imagine that some was evolved by the action of the crude vinegar. The first mention of a source of carbon dioxide occurs in a history written during the second century, A.D.; and it is evident that appreciable amounts of true white lead were produced at the beginning of the Christian era. Rhodes, Corinth and Lacedemonia are mentioned as the leading centers of production.

The Dutch process originated in Holland in 1622.

Lead and vinegar were placed in earthenware crocks, which were piled in a stack and covered with stable manure. The white lead was obtained at the end of 4 or 5 months. The Venetians, who were using the same process about this time, avoided the Dutch practice of adulteration, and their product thereby achieved a better reputation. However, the Dutch received the credit for originating the method, which still persists in essential particulars. Only slight changes have been made, such as standardizing the pots used, modifying the size and shape of the pieces of lead and systematizing the building of the stack. Spent tan bark has been substituted for stable manure. The following details refer to practice and equipment at the Pioneer white-lead factory of W. P. Fuller & Co., South San Francisco, Calif.

The metal, known as corroder's lead, is double refined and almost free from silver, antimony, bismuth and copper. The presence of such metals causes a discoloration in the product and in the paint film. The vinegar is a 2 to 3 per cent solution of acetic acid. Spent tan bark from leather tanneries is first mixed with tan bark that has been used in the corrosion process, in the proportion of 1 part of new bark to 2 parts of used bark. It is wetted to insure correct moisture content, thoroughly mixed and piled to stand until noticeable fermentation has set in, indicated by rise in temperature. It is then ready for the stacks.

The lead is prepared by melting the pigs in an iron kettle, from which the molten metal is delivered to a chain of moving molds. The flow of metal and the movement of the molds are so adjusted that the



Building the stack. Each pot contains 1 pint of vinegar and 16 to 18 buckles

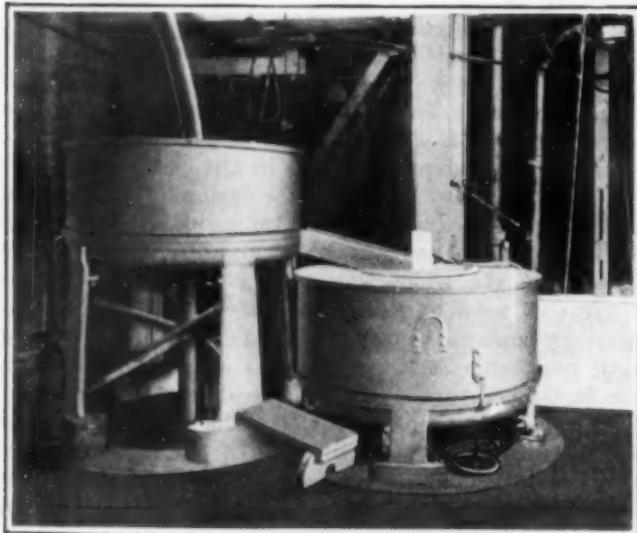
lead flows fast enough to fill the molds and the chain moves fast enough so that the lead has hardened before it gets to the point where the chain drops over the sprocket wheel. The molded lead pieces are knocked out automatically.

The lead is cast in the form of flat disks, about 5 in. diameter, $\frac{1}{8}$ in. thick, and each weighing about 10 oz. They are perforated to allow the circulation of vapors and to increase the area exposed to corrosion. They are called buckles, from the similarity to the large silver buckles at one time worn on low shoes.

The stack is a large compartment 50 ft. long by 20 ft. wide, built to a height of 20 ft. The front is made of removable planks. A layer of tan bark, 2 ft. deep, is first placed on the ground to receive the pots, which are rough earthenware containers shaped somewhat like ordinary flower pots. The lower third of the pot is smaller in diameter; and at the juncture with the top section it forms a shelf or shoulder to hold the buckles. The bottom is glazed to prevent leakage of the vinegar. The upper section of the pot contains several vents in the sides to allow circulation of the vapors resulting from the reaction.

One pint of vinegar is placed in each pot, and 16 to

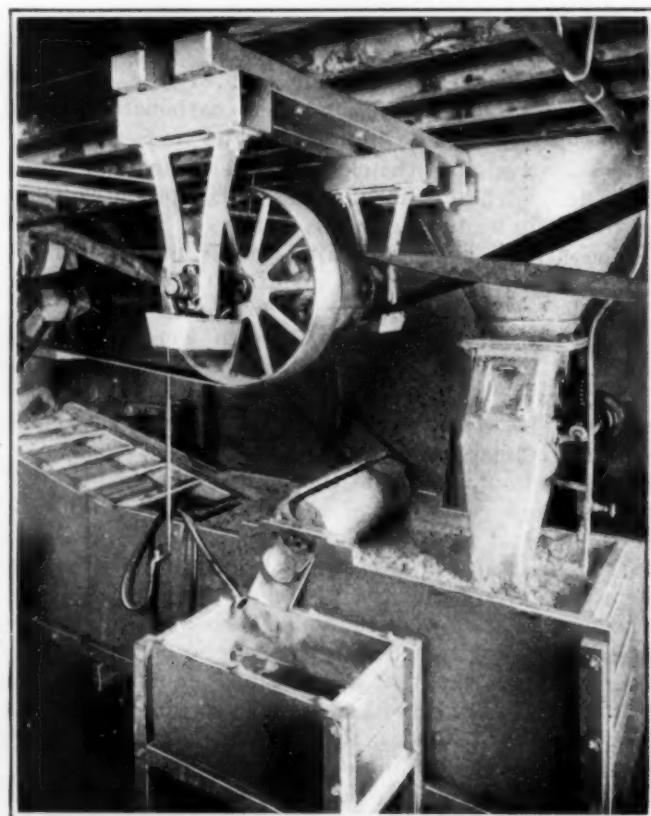
Tandem buhr mills for the grinding of crude white lead in water

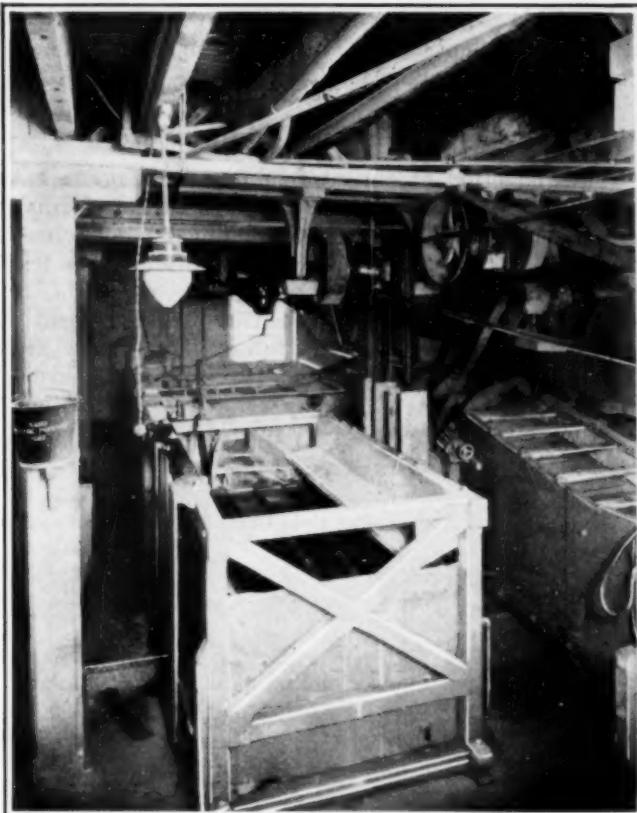


Removing the white lead. Corrosion of the buckles requires about 100 to 120 days

18 buckles are then piled in the upper part. The floor is entirely covered with pots, except a 1-ft. strip around the outside, which is filled with bark, and a space in the center of the compartment, filled with bark, through which a vent pipe passes. A tight layer of boards is then placed over the pots, followed by 18 in. of bark, then more pots, and so on until nine layers have been superimposed. Each complete stack contains about 100 tons of lead. The corrosion requires about 100 to 120 days, during which time the amount of heat that escapes through the vent in the center is closely regulated. The heat in the stack is controlled by a damper in the vent pipe. Readings with an ordinary thermometer are taken daily.

Silk screen separators and drag boxes for removal of particles of lead and tan bark



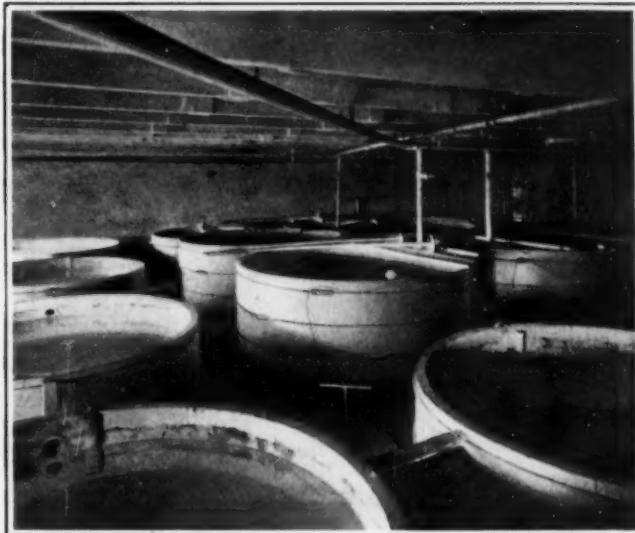
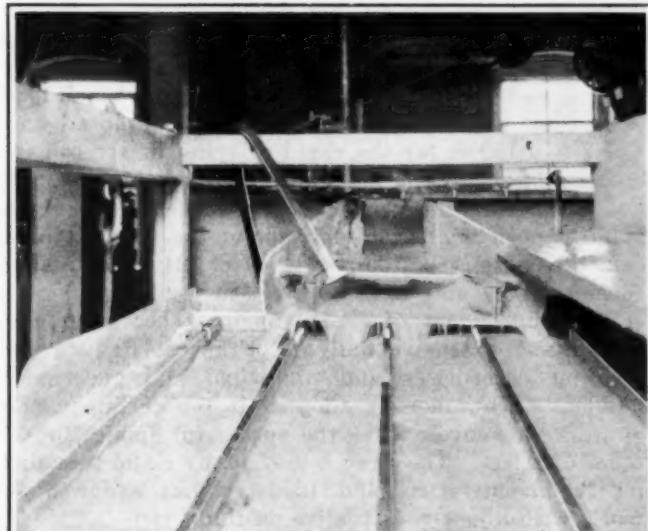


Another view of silk screen separators and the drag boxes

The reaction in the stack progresses in the following manner: The fermentation of the tan bark, which gradually heats the mass to a temperature of 160 to 170 deg. F., causes a vaporization of the acetic acid, which forms lead acetate on the surface of the buckles. This is changed to basic carbonate by the action of carbon dioxide and moisture. The acetic acid released by the reaction forms more acetate underneath, and so the corrosion extends toward the center of the buckle.

The white lead produced must be refined before being ground in oil. Tan bark, pottery, metallic lead and acetic acid must be removed. In the building and dismantling of the stack, a small amount of tan bark

Shaking screen fitted with silk cloth, for further removal of foreign matter

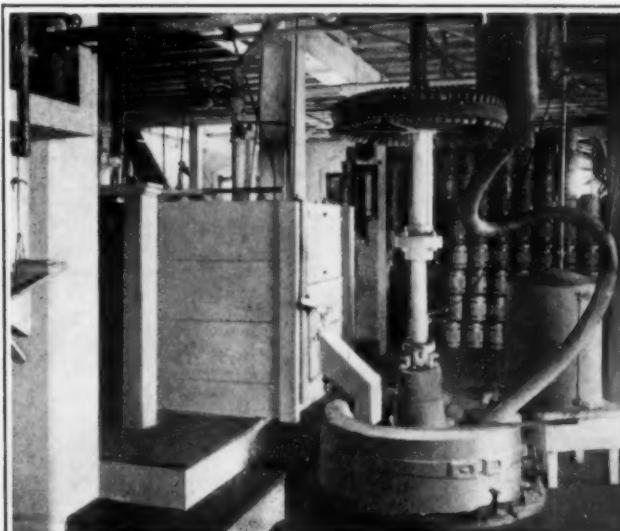


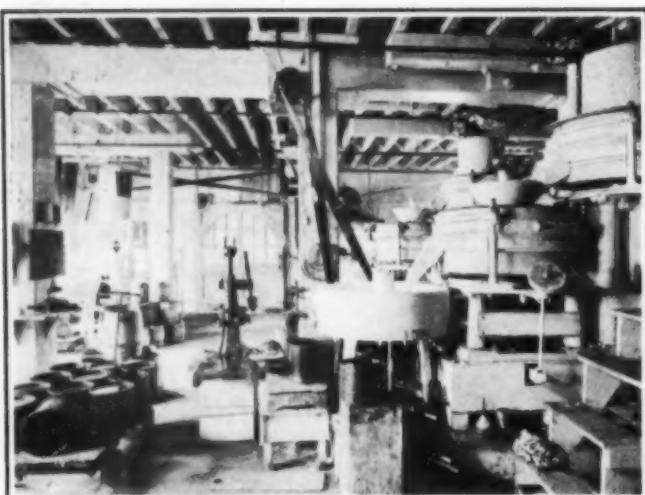
Settling tanks, operated in series, in which the water-ground pigment is thickened

drops into the pots. The weight of the stack is sufficient to crush some of the pots, and small pieces of earthenware contaminate the white lead. The corrosion is about 80 per cent complete, so that some metallic lead remains; and the excess of vinegar used leaves a small amount of acetic acid in the white lead.

The first operation is to pass the product through corrugated rolls, which crush the white lead and break it away from the metal. The mixture of white lead and metal then goes to a coarse-mesh trommel. The uncorroded lead is in the form of a thin strip of varying thickness, having the original shape of the buckle. Separation is therefore easily accomplished. The fine product then goes to a set of jiggling screens, placed one above the other, with apertures varying from coarse (above) to fine (below), placed at a slight incline toward one end. The material is thereby classified according to particle size. At the lower end of each screen it is subjected to air suction, whereby the lighter particles of tan bark and pottery are drawn off. The white lead next passes between smooth-faced rolls, which crush it to powder and flatten any pieces of metallic lead that remain. It then goes to a fine-

Agitation tank in which the water in the pulp is replaced with linseed oil





Buhr mills for the final grinding and mixing of the pigment and oil

mesh trommel, which separates the lead, the screened product passing to an agitator tank to be stirred into a large volume of water. An appreciable amount of tan bark and dirt is removed as scum.

The mixture is then ground fine in tandem buhr mills, and run in series through three float boxes, provided with agitators. The fine particles, the finished product, remain in suspension and flow from one box to the other and so out of the system. The coarse particles, which settle, are removed by a chain drag on the floor of the boxes, and go back to the buhr mills for regrinding. The white lead in water is delivered to a screen fitted with No. 21 silk bolting cloth, whereby particles of tan bark and lead are removed. It is then pumped to and flows through six tanks, where the white lead settles and from which the clear liquor containing the acetic acid is siphoned.

The settled white lead, a thick paste, containing from 40 to 60 per cent water, goes to a tall cylindrical vat, where it is heated slightly and agitated with 8 to 11 per cent of refined raw linseed oil. In a few minutes the oil replaces the water and sinks to the bottom with the white lead as an oil paste, and the water can be siphoned off. The separation is almost complete, only a few tenths of 1 per cent of water remaining in the

Corner of the research and control laboratory, W. P. Fuller & Co., San Francisco



paste. This is then ground in 36-in., water-cooled buhr mills, to mix thoroughly the oil and pigment, which is then ready for packing and sealing.

Progress in Cement Fondu in France

The production of cement fondu of an alumina base is in steady progression in France. In various forms it bears various names—ciment noir, ciment fondu, ciment électrique, electro-ciment, ciment electro-fondu, the term ciment-fondu being that generally employed.

The discovery and the fabrication of this cement in the first instance was due to Jules Bied. To its high content of alumina this cement owes its quick hardening properties. The following comparison is made of the current qualities of portland cement and ciment fondu in France:

	Portland Per Cent Comp.	Cim. Fondu Per Cent Comp.
Silica	23	10
Alumina	7	42
Lime	64	42
Iron	4	6
Miscellaneous	2	—

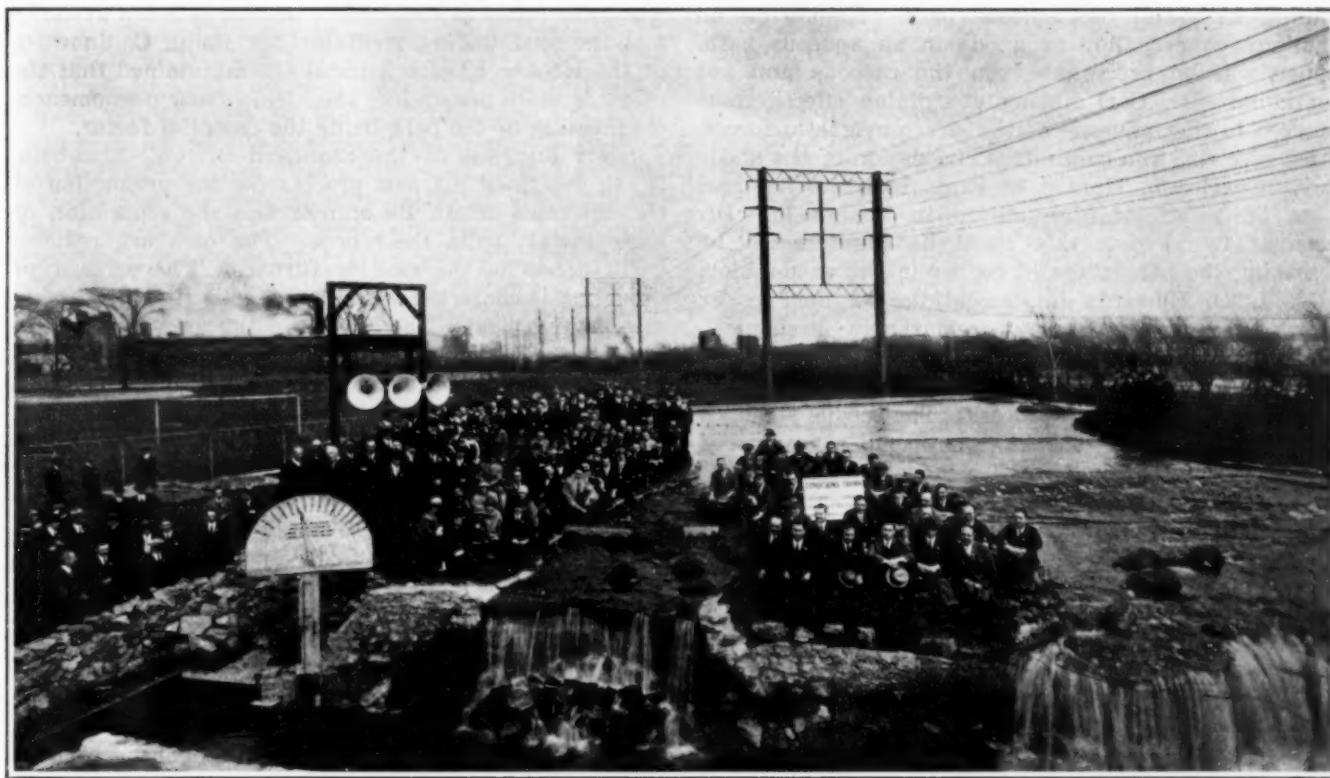
The fusion point of ciment-fondu is approximately 1,400 deg. C. This is attained readily in the electric furnace. The consumption of current varies from 1,000 to 1,400 kw.-hr. per ton.

After complete fusion, the cement is tapped through an opening in the wall of the furnace. After solidification it becomes a compact mass of a dark color, in which however the metallic compounds are often notably visible, especially the iron. These are eliminated by a magnetic process. The cement is ground in rotary grinders and carried to an extreme degree of fineness.

The manufacture is considered costly as compared with that of other cements and for the moment is supposed only to be feasible in districts where there is cheap hydro-electric power and where the bauxite, the chief raw ingredient, is to be found near at hand.

The chief plants producing ciment-fondu in France are the Lafarge company at Moutiers, in Savoy and at Teil on the Rhone; the Société des Forces Motrices de l'Agout at Luziere in the Tarn. Its rapid hardening makes it suitable for use in sea water between tides. In from 24 to 48 hours its resistance is superior to that of ordinary cements after a period of 28 days. Already known before the war, it only came into commercial production during the war period. A reserve of 300 metric tons was, during that period, always at the disposition of the French army authorities. Its use permitted the rapid mounting of big gun platforms 3 days after it had been laid. It was also used for small block houses and machine gun shelters after a rapid advance. Paris is using it for the rapid relaying of street pavements where there is an intense and continuous traffic or permitting the closing of the streets for but the briefest periods. Wheeled traffic of the heaviest kinds can thus use repaired roads after 24 hours where formerly they may have been closed for a week.

The employment of ciment-fondu is becoming more varied and extensive daily in France. Private contracting enterprises and municipal and government builders have generally adopted it for certain classes of work exclusively after the successful applications in other districts. The French may justly claim that their native inventiveness and industry has endowed the world with a new constructive medium.



Electrochemists at Niagara Falls

Record Attendance at Annual General Meeting Hear Symposium on Fused Electrolytes and Other Interesting Papers

Editorial Staff Report

THE American Electrochemical Society held its 47th convention at Niagara Falls, N. Y., April 23 to 25, 1925, a convention that broke all past records. Niagara Falls has for many years been the American center of the electrochemical industries. It was here that a number of the important electrolytic and electric furnace processes were developed on a dominating commercial basis: processes such as those of Acheson Graphite and Carborundum which have gained an international market and reputation. Due partly to this unique position of Niagara Falls in the electrochemical industry, but due largely also to an exceptionally attractive program and a very able chairman, the convention of the electrochemists attracted delegates from all parts of the country and from a number of the European centers. The total attendance exceeded that of the recent Philadelphia and New York meetings.

Aside from the technical features of the program, the visits to various plants and the drives to the surrounding natural scenic beauties under ideal weather conditions, added much to the enjoyment of the meetings. The recently completed Hotel Niagara, an imposing modern twelve story structure, served as an ideal convention center and afforded ample opportunities for intimate contacts and informal discussions among the members in attendance. Of the local committee, Messrs. Lyman C. Judson, G. Prescott Fuller, George Campbell, John B. Glaze, G. D. Muggleton, H. P.

Martin, F. A. J. Fitzgerald and the inimitable Lydbury, with his personally conducted movies, were ever conspicuous in their untiring effort.

The symposium on "Fused Electrolytes" occupied all of Thursday, April 23. The chair was occupied by William G. Harvey, an international authority on this subject. The contributions to this symposium will ever remain a classic in the annals of the society. It was at this symposium that many of the important details pertaining to the manufacture of metals such as magnesium and aluminum, in particular the new pure aluminum, were made public for the first time.

The introductory paper was by Prof. C. J. Brockman of the University of Georgia. He outlined briefly the classical researches of Davy, Faraday and Lorenz that resulted in the modern fused electrolyte industries best typified by that of aluminum. Dr. F. C. Frary, Director of the Research Laboratories of the Aluminum Co. of America, next submitted an account of the recently patented Hoopes process for the electrolytic refining of aluminum. This paper will be found reprinted in full in this issue.

Discussing the Hoopes cell, Prof. O. P. Watts of Wisconsin inquired as to the extent of the polarization. In reply, Dr. J. D. Edwards, Assistant Director of the Aluminum Co.'s Laboratories, stated that according to measurements polarization is practically absent. Prof. Louis Kahlenberg of Wisconsin called attention to the striking difference between the fused electrolyte

refining bath and the aqueous bath. Employing an aluminum-copper alloy as anode in an aqueous bath, copper will be precipitated on the cathode and not aluminum. Dr. Carl Hering of "pintch effect" fame referred to the influence of the electromagnetic forces. These give rise to a continuous circulation of the anode alloy. Charles L. Mantell of Pratt Institute inquired as to the effect of high silicon in the anode. Dr. Edwards found that this could be counteracted by increasing the percentage of copper in the anode alloy.

Dr. J. D. Edwards in presenting the next paper recorded some of the many remarkable mechanical, chemical and electrical properties of the new aluminum which differs materially in its properties from aluminum made by the Hall process. The tensile strength of pure aluminum is 600 kg. per sq.cm. as compared with 900 kg. for ordinary 99.4 per cent aluminum; the per cent elongation is 60 as against 45 per cent for ordinary aluminum. Pure aluminum is very resistant to corrosion: a sample of pure aluminum submerged in dilute hydrochloric acid showed no appreciable corrosion after six weeks' immersion. This resistance to HCl is particularly striking. In this respect aluminum resembles zinc, as pointed out by William H. Finkeldey, of the New Jersey Zinc Co., in discussing Edwards' paper. Pure zinc is very resistant to HCl and when exposed to the air retains its bright surface indefinitely. Dr. F. Zimmerman of Baker & Co. told of his experience with platinum. The properties of this metal were effected upon melting in absence of air.

THE ANODE EFFECT

Cyril S. Taylor, physical chemist of the Aluminum Co., gave an account of his study of what has always been one of the most interesting phenomena in the electrolysis of fused salts, the so-called "anode effect." Taylor has made a careful analysis of the early observations of the anode effect and its causes. He concludes that the anode effect may be brought about by any combination of conditions which permit local overheating at any point of the anode surface. This establishes the gas film at that point, and by thus diverting current to other parts of the anode area, which are already in a metastable state, overloads them and results in the practically instantaneous spread of the film over the whole anode surface.

Commenting on Dr. Taylor's findings, Raymond R. Ridgway of the Norton Co., referred to his experience with fused $\text{NaCl} + \text{CaCl}_2$. Under certain conditions a blue envelope would cover the surface of the anode, separating the anode completely from the electrolyte. He could get this effect even with alternating current. This surprised Dr. Hering; furthermore, the chair, William G. Harvey, referred to installations where superimposed a.c. seemed to counteract the building up of the voltage due to the anode effect. Prof. F. C. Mathers, of Indiana University, the inventor of the fluorine generator cell, found that the gas film would appear within wide limits of the temperature of the fused bath. Dr. Mathias O. Sem of Kristiania referred to tests recently reported upon by Kurt Arndt who found that both the porosity of the anode carbon and the anode current density were important factors. Merlub Sobel of the Kemet Laboratories, Cleveland, suggested that the better heat conductivity of the graphite anode as compared with that of ordinary carbon would tend to increase the effect with the latter material. Prof. M. A. Hunter believed that the true explanation

was to be found in the surface tension between graphite and the surrounding medium; but Ralph C. Snowden of the Hooker Electrochemical Co. maintained that the effect is more nearly like the leidenfrost phenomenon, overheating of the bath being the essential factor.

Louis Burgess, of the Standard Oil Co., Elizabeth, N. J., described his new process for the production of the chlorides of Al, Be and Zr and the separation of these metals from their ores. The ores are reduced with carbon in the electric furnace. The product of reduction is contacted with dry gaseous HCl, preferably at a low red heat. The corresponding anhydrous chlorides are formed, which volatilize and may be condensed in a substantially pure condition. The respective oxides may be obtained by solution in H_2O and evaporation, which produces complete hydrolysis.

Comparing Burgess' process for making AlCl_3 directly from the ore, bauxite, Dr. J. D. Edwards briefly described the process used by his company: Aluminum dross together with a little Al_2O_3 and carbon are treated directly with chlorine gas. A pure product is obtained. A very similar process is employed by the Klipstein Co., B. H. Jacobson, pointed out. He reported that his company is producing 200,000 lb. of aluminum chloride per month starting with aluminum metal residues of all kinds. Professor Kahlenberg referred to his experience with silicon tetrachloride. This would not conduct electrically at any temperature.

MAGNESIUM BY THE OXIDE PROCESS

Mr. William G. Harvey, vice-president of the American Magnesium Corporation, presented at length his experience in the manufacture of metallic magnesium from fused salts, devoting particular attention to the oxide process for which he is so largely responsible.

The concluding paper of the morning session was offered by Prof. H. C. Kremers on a study of the preparation and properties of metallic cerium which he together with Mr. Herman Beuker had carried out.

Metallic cerium free from iron was prepared by the electrolysis of the fused chloride, using graphite cells and carbon anodes. Some 300 grams of metal were prepared. The metal corrodes easily in dry air. It is highly malleable and ductile. Some of its physical constants as re-determined are as follows: Density at 15 deg. (absolute alcohol), 6.77; Brinell hardness (500 kg. weight) 21; heat of combustion 1,661 cal. per gram; kindling temperature 165 deg. C. The pure metal is moderately pyrophoric. Its alloys, which are harder than the pure metal, are very pyrophoric. The metal shows marked tendency to act as a "getter" when sealed in partially evacuated tubes.

Professor A. W. Aten, of the University of Amsterdam, in co-operation with Messrs. H. J. den Hertog and L. Westenberg carried out a series of experiments with fused electrolytes, in order to determine the nature of the electrodeposited metal when such metal is deposited in the solid form. The choice of salts is rather limited. Experiments were confined largely to silver and copper salts, as the melting point of silver and copper is decidedly higher than the melting point of their halide salts. Differences in the temperature of the cathode plate caused irregularities in the distribution of the deposit, the tendency being for the metal to redissolve from the hotter portions of the cathode and to build up on the colder portions. Silver cathodes that had a crystalline surface to begin with, caused the deposited crystals to grow as a continuation of the

crystals in the plate. Polarization voltage was low in all of the electrolytes, and decreased with rising temperature of the bath.

Prof. Richard Lorenz of Frankfurt, one of the foremost investigators in the field of fused electrolytes, submitted a very interesting treatise on the equilibria that exist between metals and salts in a fused bath. In the past the author has investigated a large number of fused electrolytes. The behavior of these differs markedly in a number of respects from the behavior of dilute aqueous solutions. Selecting two of the more simple equilibria, namely,



and



he discussed at length the reactions taking place, and then proceeded to record the effect of a diluent to (1) the salt phase and (2) the metal phase. Results obtained depend very much upon whether or not the diluent is a strictly indifferent salt or metal.

The second contribution to the symposium by Professor Kremers of the University of Illinois dealt with the preparation and properties of neodymium. The production of high-grade neodymium metal by reduction with sodium was not found successful. Electrolysis of Nd_2O_3 in cryolite gave alloys high in aluminum. Electrolysis of Nd_2O_3 in mixtures of NdF_3 and KF gave unsatisfactory results. Considerable quantities of metallic neodymium was prepared by electrolysis of fused NdCl_3 , with small amounts of NaCl . For production of high yields, electrolysis must be continued long enough to reduce the neodymium sub-chloride which is first formed.

CERIUM-FREE MISCH METAL

The authors, A. Paul Thompson and H. C. Kremers, prepared cerium-free misch metal by electrolysis of the fused chlorides in both cast iron and wrought iron cells. Some 132 grams of metal were obtained. Analysis showed the presence of 11.8 per cent iron in Metal A and 32 per cent of iron in Metal B. The metal is tin white, tarnishes in air and is brittle. Some physical properties are: Melting point Metal A, 975 deg. C., Metal B, 1,050 deg. C.; specific gravity at 15 deg. C., Metal A, 6.96; kindling temperature, Metal A, 195 deg. C., Metal B, 280 deg. C. The metal is pyrophoric even though cerium is absent, and lanthanum and neodymium as individuals show no pyrophoric properties.

The final contribution of the symposium was by Herman H. Kahlenberg, son of the well known professor. He carried out a long series of experiments preparing boron by all of the important methods known. Boron as well as several borides were prepared by electrolysis of fusions consisting of potassium chloride and potassium borate. A new boride, that of palladium was prepared by this method. The preparation of boron by chemical replacement were also studied. The best results are obtained by the action of powdered aluminum on potassium boro-fluoride. Fused boron was prepared by a new method, that is, by the reduction of Moissan's boron (B_2O_3) with aluminum in the arc and oxyhydrogen flame. The single potential of boron was found to be -0.028 v. when a special, natural potassium borate is used as electrolyte.

The first part of the Friday session was devoted to the annual business meeting, briefly reported upon elsewhere. President Howard C. Parmelee, editor of

Chem. & Met., then delivered his presidential address, "The Element of Surprise in Engineering." Following this were two papers on organic electrochemistry, the one by R. R. Read and F. A. Fletcher, the other by Charles A. Mann and Paul M. Paulson. The closing paper of this session was by D. T. Ewing and H. W. Schmidt on the Electrolytic Preparation of potassium bromate. At noon the members gathered at "the Round Table" and discussed the teaching of electrochemistry. Professor O. P. Watts presided. Friday afternoon was devoted to a visit to the large model of the Falls, shown as the headpiece of this report, inspection of the new power house of the Niagara Falls Power Company and the exhibition of the many varied magnesium products as arranged by William G. Harvey of the Magnesium Corporation.

On Saturday Dr. William Blum stirred up a heated discussion with his paper on "Electrolytes and Ionogens" in which he recommended to confine the use of the term "electrolyte" to the conducting solutions or conducting media, and to adopt the term "ionogen," suggested by Alexander Smith, to mean any salt or chemical compound capable of forming ions. Dr. Max Knobel submitted the results of his investigation on the "Effect of Surface Condition on Overvoltage." In all cases the hydrogen and oxygen overvoltages on spongy electrodes were smaller than on smooth electrodes. The lowering of overvoltage appears to be due to the changed nature of the surface, rather than simply due to the greater magnitude of the surface.

M. R. Thompson, of the Bureau of Standards, in a study of the "Nickel Plating of Zinc and Zinc Base Die Castings," said that, in order to nickel plate zinc or zinc-base die castings, it is necessary to apply a cathode potential at least equal to that with which the zinc tends to dissolve in the nickel solution, which is about -0.80 volt. Either sodium or magnesium sulphate is recommended. The advantages of such solutions include high throwing power, high conductivity, ease of analysis and control, stability and low cost. About the same polarizing effect is produced by either sodium or magnesium sulphate, but sodium sulphate gives lower resistivity and higher throwing power and is therefore preferable.

A new "Method for Zinc Coating Wire" was presented by J. L. Schueler, of the Keystone Steel and Wire Co., Peoria, Ill. The process differs from the old galvanizing process in that wiping of the coating is obviated and a new step introduced—heat-treatment of the zinc coating—which smooths the coating, distributes it uniformly around the surface of the wire and makes the heavy coating malleable and flexible. The process is in daily use, and several thousand tons of wire have been successfully zinc-coated. The galvannealed coating was shown to be composed of an outside layer of zinc; an intermediate layer of FeZn_{10} ; inside layers of FeZn_8 and FeZn_7 ; and finally a layer of FeZn_5 next to the surface of the wire.

The final paper on the program was by A. L. Ferguson and Gerrit van Zyl on "Transfer Resistance." By a very carefully conducted set of experiments the authors demonstrated almost conclusively that the discharge potential of an electrode would be the same as the charge potential if the two could be measured at the same instant by the commutator method, and that both would be the same as the value by the direct method. This leads inevitably to the conclusion that there is no such thing as "transfer resistance."

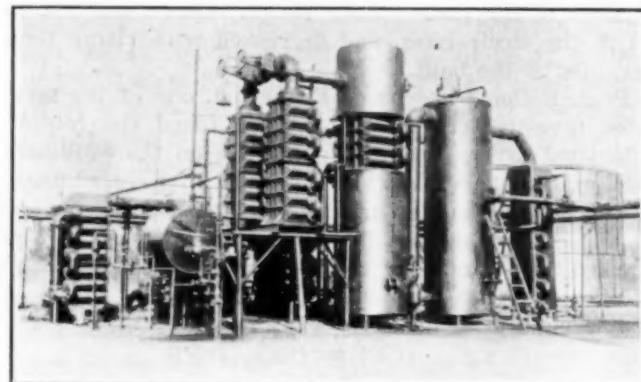
Evaporating and Dephlegmating Casing-Head Gasoline

Objectionable Features of Horizontal Type of Still Absent from New Vertical Design

TWO general methods of evaporation and distillation are available for removing casing-head gasoline from absorption oil. On the Pacific Coast, however, the steam still is considered preferable to the fire still as it avoids fire hazard, and the possibility of cracking the absorption oil and thereby producing an off-color gasoline.

The objectionable features of the usual horizontal pan-type steam still are absent from a vertical evaporator that has recently been developed by the Southwestern Engineering Corporation, of Los Angeles. This new type, of cylindrical construction, is being built in sizes ranging from 46 to 72 in. diameter, and about 16 ft. high. The rich mineral seal oil is preheated to about 320 deg. F., before entering the evaporator, to which it is delivered at a point 18 in. below the top. It is carried to a center distributor that delivers direct to a series of corrugated steps or riffles, over which the oil flows downward in one direction for about 18 in., the direction of flow being thereafter reversed. Four sets of riffles are provided giving excellent agitation and allowing the light ends to escape. The oil collects at the bottom of the last riffle in a second distributor, and from there passes downward over a series of alternate pans and corrugated cartridges until the bottom is reached. An open steam coil is submerged in the bottom of the evaporator, for the admission of live steam at about 125 lb. gage pressure.

The final gasoline in the absorption oil is released in the lower part of the evaporator; and the excess steam vapor, together with the gasoline vapor, passes upward through the corrugate cartridges and sweeps over the thin film of rich mineral seal oil passing down over them. An opening in the side of the pan above each cartridge allows the ascending vapor and steam to pass upward. These openings alternate with each pan, thus preventing bypassing and bringing the steam in close contact with the oil. With this type of evaporator no difficulty is experienced in stripping the oil to less than 0.5 per cent of its original enrichment. The large vapor passage from the top of the first cartridge to the top of the evaporator makes overloading impossible



Operating Arrangement in a 20,000-Gal. Gasoline Absorption Plant
Right to left—Preheater, steam still, dephlegmator surmounted by control section and mist extractor, gasoline condensers, gasoline water separator and gas coolers.

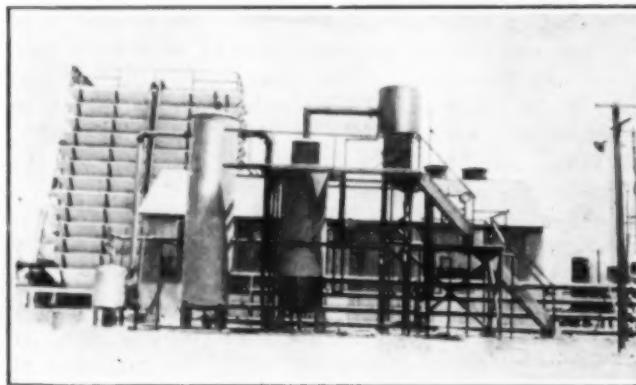
and prevents oil or froth from being thrown over the top of the apparatus.

The gasoline vapor passes to the lower or reflux tower of the dephlegmating unit, which is 46 to 72 in. diameter and filled with pans and trays. On top of the reflux tower a section is used for the temperature control of the vapor going to the condenser. The gasoline vapor passes around the tubes, and the rich oil or water (the cooling medium) passes through the tubes. The oil, when used thus, is taken from the heat exchanger at a point where it is properly tempered to give the desired vapor temperature, control being either automatic or manual.

No difficulty is experienced in maintaining close regulation of the vapor temperature, which may range from 160 to 220 deg. F., depending on the pressure in distillation system and on the product desired. The vapor, after leaving the control section, passes to a centrifugal mist extractor, where baffles knock down any entrained heavy ends that may have been carried over mechanically.

The knock-out from the control section passes downward over successive pans and trays in the reflux tower. Any light ends knocked down by the control section are re-evaporated and carried upward through the control section, the heavy ends being gathered in the bottom of the reflux tower and discharged by means of a tank float and control valve, to be returned to the system.

This combination of practice and equipment permits the delivery of a 25 plus Saybolt color gasoline. The end point can be controlled as desired by varying the amount of cooling medium passing through the dephlegmator control section.



View of 5,000-Gal. Gasoline Absorption Plant
Left to right—Preheater, steam still, dephlegmator surmounted by control section and condenser surmounted by mist extractor.

Electroplating Conference

Recently a conference was held at the Bureau of Standards with the officers and the research committee of the International Association of Electrotypers. Since July, 1924, this organization has maintained a research associate at the Bureau for the study of nickel electrotyping. The results obtained in this research up to the present time were placed before the committee and discussed. The committee commented favorably upon the progress made in the work.

Satisfactory progress is also being made in the study of the protective value of nickel plating upon iron and steel, although no very promising means have yet been discovered of effecting any marked improvements.

Some Modern Gypsum Products

A Review of Progress in the Production of Gypsum and Plaster Materials for Use in the Construction Industries

By J. M. Porter*

While gypsum plaster and gypsum used as fertilizer are well known materials it is doubtful if the chemical profession as a whole is familiar with the later developments of the use of gypsum in the so-called "gypsum structural products." Inasmuch as their use is so varied and the tonnage of raw material used in their manufacture is large it is believed a brief description of their production and use will be valuable.

As the name indicates, the basis of the composition of gypsum products is the rock forming mineral gypsum, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Several varieties of the mineral are of commercial importance, including rock gypsum, gypsum sand and gypsite. The latter is a disintegrated, earthy form found usually on or near the surface and not lending itself readily to the manufacture of structural products, the rock and sand being most suitable. A by-product material of certain chemical processes, consisting essentially of hydrated calcium sulphate is at present also used in the manufacture of these products.

The treatment of the raw material resulting in the formation of calcined gypsum is a comparatively simple process, consisting of three major sub-division, namely: (1) mining or quarrying, (2) crushing and (3) calcination. After the rock is brought to the mill and crushed it is heated in one of several types of calciners to a temperature of between 107 deg. C. and 140 deg. C. At this temperature three-fourths of the water of crystallization is driven off and the material becomes calcined gypsum or hemi-hydrate in accordance with the following reaction:



If the heating is continued and the temperature raised to about 200 deg. C. the remaining water is driven off and soluble anhydrite or "second settle stucco" is obtained:



Both of these products are used in the manufacture of structural gypsum products. Each has properties which make it adaptable for specific purposes.

When water is added to either the hemi-hydrate or the soluble anhydrite a reaction occurs in which the water is taken up and gypsum is reformed. It is upon this property and the fact that the time of set can be controlled that much of the value of gypsum in all uses depends, together with the high strength of the set product upon drying out. The control of the time of set is so flexible that it is possible to obtain a set at any pre-determined time.

GYPSUM PLASTER AND WALL BOARD

The first structural gypsum products used to any great extent were gypsum plaster board and wall board. These products were offered on the market as early as 1908. Gypsum plaster-board is used as a lath for the reception of plaster. The nominal size of the sheets is 32 in. by 36 in. by $\frac{1}{8}$ in. Wall board is similar in construction and composition with a slight difference which will be noted later. It is not designed to be

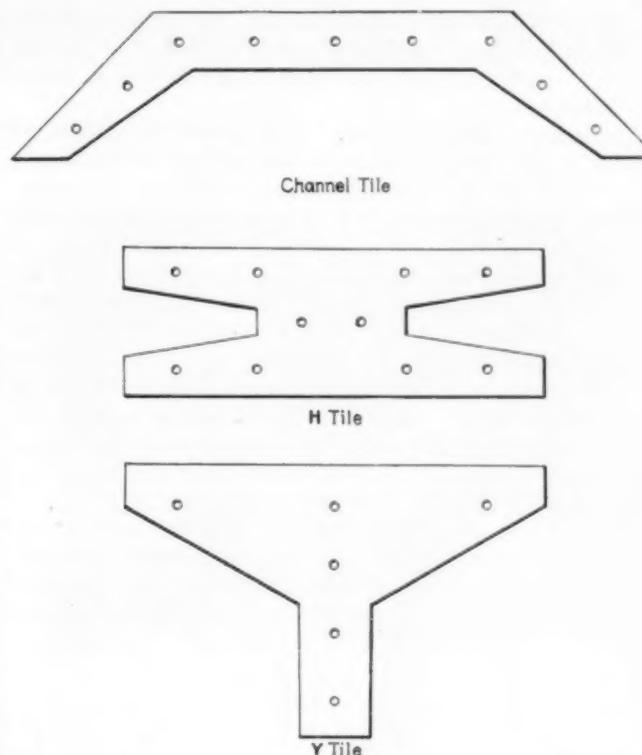


FIG. 1—Long Span Channel, H and Y Tile Made From Gypsum

plastered. The nominal width of wall-board is 48 in. and thickness $\frac{1}{8}$ in. Its length is from 6 ft. to 12 ft.

Gypsum plaster and wall board are essentially of the same composition, consisting of one or more layers of hydrated calcined gypsum between sheets of a fibrous material. They are both erected by nailing directly to the wooden studding or by clipping with metal clips to metal channels or angles. Inasmuch as the surface of wall-board may be the exposed surface of a finished wall or ceiling it is usual to have at least one side of the wall-board sized or given other special finish. After the erection of the wall-board the joints are either pointed up, papered over or covered with wooden strips.

There are a number of features obtainable in wall or plaster-board construction which account for its present popularity, several of which include: low cost, relatively low combustibility, ease of erection, economy in plaster and lightness. Besides its use as a lath, plaster-board has found use as a protection against fire for wooden beams and columns and as a sound deadener for concrete floors.

The processes of manufacture of gypsum wall and plaster-board are identical. They are made upon the same machine, the only difference being that with wall-board a little more attention is paid to details so as to obtain a more uniform product. Hemi-hydrate, wooden chips, an accelerator and the water necessary are mixed together in a container. The accelerator is usually ground gypsum. Sufficient water is used to give a mix of easy pouring consistency which is run out of the mixing hopper upon a belt carrying a strip of the surfacing material. The wet gypsum mix is distributed uniformly over the width of the surfacing layer of paper or other material after which another layer of surfacing material is brought into contact with the top surface of the wet mix and the whole is passed through rolls to give a uniform thickness. The board then travels along the belt for a distance of about 200 ft. at a speed of 10 ft. per min. This allows the gypsum

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to set so that when the end of the belt is reached the board is hard and rigid and easily cut into the desired lengths. After cutting, the board is dried and is ready for shipment.

The second largest tonnage of gypsum for structural products goes into the manufacture of gypsum partition tile. The hemi-hydrate is used exclusively in the manufacture of this product, which is made by casting and always at the mill, being transported to the place of erection. Generally the size of tile is 30 by 12 by 3 in. and it has four circular cores of 1½ in. diameter extending the length of the tile. Tile of other thicknesses, up to and including 6 in. are, however, on the market for specific purposes. The major use of gypsum tile is in interior partitions, although there are a number of other purposes for which this material is used, including protection against fire of beams and columns, insulating of concrete roof decks, and for furring purposes.

The molding of gypsum partition tile may be done by either machine or by hand. The wet mix is made of calcined gypsum, chips or fibre, and water. Accelerator is used and it may be added either in the mixing hopper

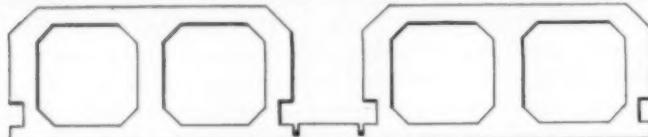


Fig. 2—Hollow Precast Floor Tile Made From Gypsum

or after the material has left the mixing hopper. If hand made, the wet mix is delivered to the moulds, which are usually racked so as to cast five tile at a time. The gypsum is allowed to set, the cores withdrawn and the tile removed from the forms. The tile are then stacked on cars which are run into a drier.

PRECAST ROOFING TILE

As the name indicates this type of gypsum tile is cast at the mill and is used for roofing purposes. However, some types of this tile are made for floor construction. Several standard shapes and sizes of precast roofing tile are available, including:

Short Span Tile. These are 30 in. in length, 12 in. wide and either 3 or 3½ in. thick. The 3½ in. tile are cored (hollow) while the 3 in. are solid. They are erected by laying directly on the purlins, which are iron T's. The spaces between tile are filled with gypsum grout.

Long Span Hollow Tile. These tile are similar in shape to the short span tile but are much heavier as they are intended to be used on spans up to and including 8 feet. The width of this type tile is 18 in. and it is 6 in. in thickness. Erection is done in a manner similar to short span tile. In some instances to facilitate erection this type and short span tile are cast with lap joints.

Long Span Channel, H and Y Tile. These tile are cast in the shapes indicated in Fig. 1. They are designed for spans of from 4 to 8 ft., are 18 in. wide and 5 or 6 in. in thickness. They are erected by laying directly on the steel or wood framing, the joints being filled with gypsum grout. The Y and H shaped tile are designed for floor construction and when an undersurface is desired which is to be plastered the H shape tile is used.

In order to obtain the maximum strength and minimum porosity, precast roofing tile are cast from "second settle stucco." All types are reinforced with No. 14 galvanized wire of 6 by 3 in. mesh.

Precast floor tile is also cast at the mill and shipped to the place of erection. The size of the units are 19 in.

wide by 18 in. long with thickness of 6, 8, 10 or 12 in. The standard shape is as indicated in Fig. 2. This tile is laid directly on the supporting members. The spaces on the upper side are filled with concrete. The lower surface is smooth, offering an excellent base for the reception of plaster.

POURED-IN-PLACE CONSTRUCTION

Two types of poured-in-place gypsum constructions are at present employed, one, the so-called suspension system, has been in use for a number of years, while the other is a comparatively new use of gypsum. In the former the reinforcement employed is not dependent on the gypsum mass for the full development of its tensile strength, but must be secured (independently of the gypsum) to the supporting construction. Before the pouring of the gypsum mix the reinforcement is brought into tension and is temporarily secured to the form work. This condition is maintained until after the mix has been poured and is set. The strength required for the cables is calculated by accepted formulas and depends upon the loading, the length of span, and the sag given the cables. The lightness of this type construction is one of its features, weighing 4 lb. per sq.ft. per in. thickness. The composition of the mix used varies somewhat from place to place but is approximately 85 per cent calcined gypsum, 15 per cent wood chips, excelsior or vegetable fibre by weight. The cables usually consist of two No. 12 twisted galvanized wires spaced 1 to 3 in. on centers.

In the other system the reinforcing consists of wire mesh, which is usually No. 6 galvanized wire, 4 in. on centers tied together with smaller wire 12 in. on centers, embedded in the bottom of the gypsum slab, as opposed to the taut cables of the suspension system. The mode of erection is also different in that no formwork is necessary. The supports are iron T's, 32 in. on centers, across which are laid at intervals of 36 in., 1 in. T's. Into these 32 by 36 in. spaces are placed ½ in. plaster board and over the whole is laid the wire mesh, and the gypsum mix poured to the desired thickness. It is claimed by the erectors of this system that when the gypsum sets around the wire mesh any superimposed load brings the reinforcement into tension, thus enabling the gypsum slab to carry the load to the supporting beams.

Hardness of Varnish and Paints

Two reports of the Paint Manufacturers' Association have recently been issued as circulars 228 and 229 of that organization discussing hardness of varnish and other films. In the first of these, Dr. Henry A. Gardner in charge of the research laboratory of the Association, reports on a variety of methods which have been used in the industry. A new method devised by Percy H. Walker and L. L. Steele of the Bureau of Standards is described in the second circular. This new method uses a device consisting of a balanced swinging beam which slows down in its pendulum movement more or less rapidly according to the hardness of the varnish film on which the beam vibrates.

The results found for a variety of commercial varnish films indicate that it will be possible to make a quantitative specification of the hardness of the varnish in definite periods of time. By this means the drying characteristics of the varnish will be more accurately defined than has hitherto been possible.

Glimpses of a Modern Dry Color Plant

New Factory of the Corona Chemical Division of the Pittsburgh Plate Glass Company at Milwaukee a Model of Efficient Design

WITH the completion of a new dry color and insecticide plant at Milwaukee, the Corona Chemical Division of the Pittsburgh Plate Glass Company has contributed to the industry and allied fields a model of production efficiency, unique in layout and equipment. The building and much of the machinery is of special design, and many innovations in the manufacture and handling of dry colors and insecticide materials have been introduced.

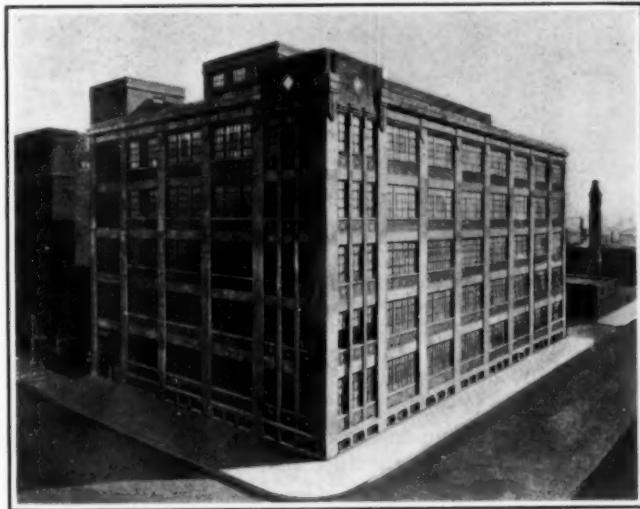
The building is constructed entirely of concrete, and architecturally, it is designed to conform to other structures recently completed. It has 5 floors together with basement and pent house, of 13,000 sq.ft. per floor.

In the design of the new plant, 3 important features have been stressed, namely, the installation of all equipment necessary to reduce labor and manufacturing



Mechanically Driven Dissolving Tubs

Material is fed from overhead hoppers that are supplied from the main storage hoppers



New Milwaukee Plant of Corona Chemical Division
The building is entirely of concrete and has a total floor space of 85,000 sq. ft.

expense, the positive surety of quality of product at all times, and the complete elimination of possibility of industrial poisoning from both raw material and manufactured product. The company points with even more pride to the improvement in labor conditions than to the increase in quality and quantity of product achieved by the new methods installed in the new building.

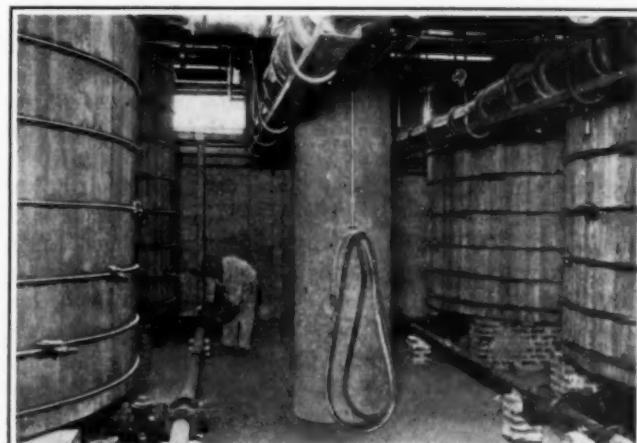
Lead products constitute the greater bulk of raw material used for the manufacture of dry colors and insecticides. The latter consist largely of lead and calcium arsenates, bordeaux and copper carbonate. The dry colors are produced by the process of precipitation, and consist of chrome yellow, chrome green, Chinese and Prussian blues, para red, toluidine red, and color lakes of all kinds.

The main precipitation tubs are located in the basement. These tubs are flush with the ceilings, and sections of the first floor are removed, leaving quarter segments of each tub accessible, permitting a great amount of the first floor to be used for working space. Each of these tubs is equipped with individual worm gear and clutch, and those from which vapors arise

are hooded and ventilated. Provision is made for doubling the number of precipitation tubs at a later date.

One of the most distinct innovations is in connection with the handling of raw material. All lead products are handled through a vacuum system directly from the cars on the side-track to large storage hoppers. All the disadvantages of small quantity unloading are eliminated. From the storage hopper, the raw material is automatically discharged into weighing hoppers. From this point the raw material is conveyed by an overhead track to dissolving tubs which are on the first floor. The hopper automatically discharges the material at any rate desired into the dissolving tubs, the entire process being ventilated so as to prevent any dust from escaping into the plant.

Other raw materials are made up in solutions in large tanks adjacent to the dissolving tubs and are drawn as needed, instead of being dissolved for each individual batch. At this stage of the process a distinct change in the mode of handling colors has been in-



Main Precipitation Tubs in Basement

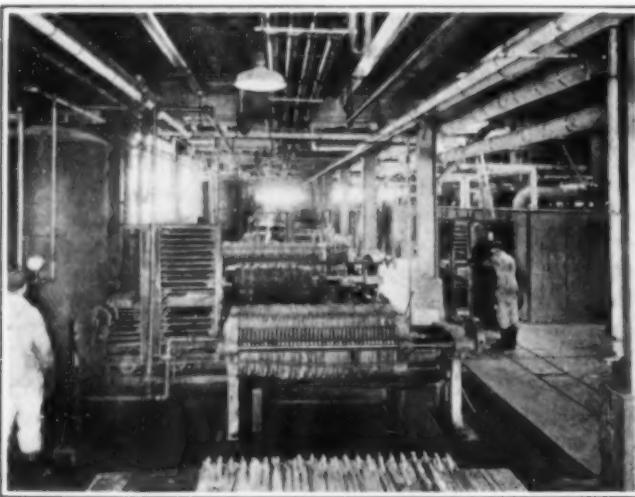
The washed material is pumped to the pent house instead of being pressed at this stage



Pent House Balcony

Each set of precipitating tubs has a corresponding tub in the pent house, easily accessible from a balcony

stalled. After the color has been precipitated and washed, it is pumped directly to the pent house at the top of the building, where the material starts in process. The tubs in the pent house have a capacity for 2 or 3 batches of material. The pumps have a capacity of 200 g.p.m. and quickly empty the precipitation tubs. The time and labor saving advantages of this method are obvious. The old method of trucking material to upper floors is eliminated. Immediately after final washing, the precipitation tubs are emptied in 10 minutes and are available at once for another batch. As



Filter Press Station

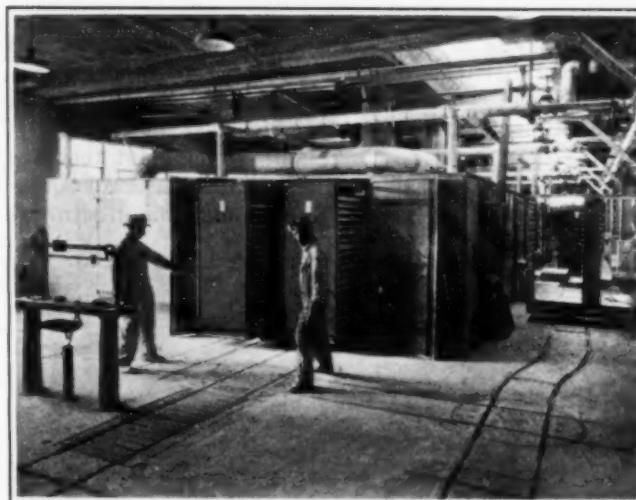
From the tubs in the pent house, the material passes by gravity to tanks near the presses

a consequence, the 2 precipitation tubs on the striking floor and 1 in the pent house have the same capacity as 4 tubs had in the old process.

From the tubs in the pent house, the material flows by gravity to large receiving tanks on the floor below. From these it is discharged by air pressure into filter presses where the solid matter is retained and the water discharged. These presses are fitted in recesses in the floor and the discharge from them is drained into settling tanks in the basement. By this method any material that may be carried along in the water due to leakage or broken filter cloth, is collected. The filter press cake is removed from the presses and placed on metal trays on metal racks. Corrugated aluminum trays have been supplied in place of the ordinary wooden

tray, giving greater advantage in handling and drying, and, although increasing the original investment, this results in ultimate economy. Trucks on metal tracks imbedded in the concrete floor are available for transporting the material to the dry houses for final drying. The floor is equipped with main tracks and turn-tables so that all dry houses and presses can be served from any point.

When the drying process is completed, each rack is passed over a floor scale to weigh the contents. Instead of each tray being removed and dumped individually, according to the regular practice, the entire truck load is placed in a dump hopper and the entire truck dumped at one operation. This not only results in a great sav-

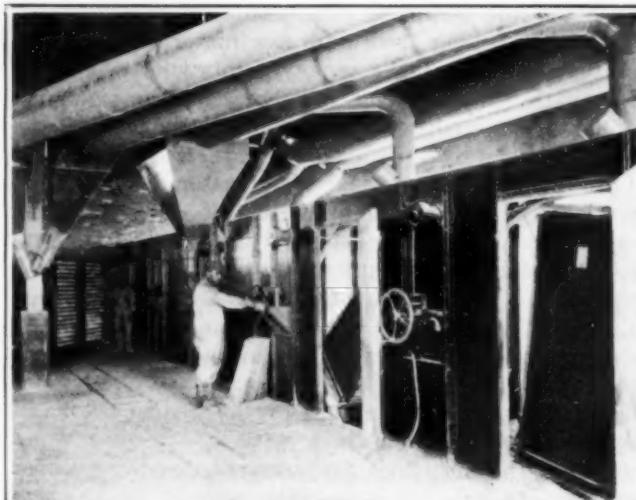


Weighing the Dried Material

Dried filter press cake is passed over a floor scale while it is still on the racks

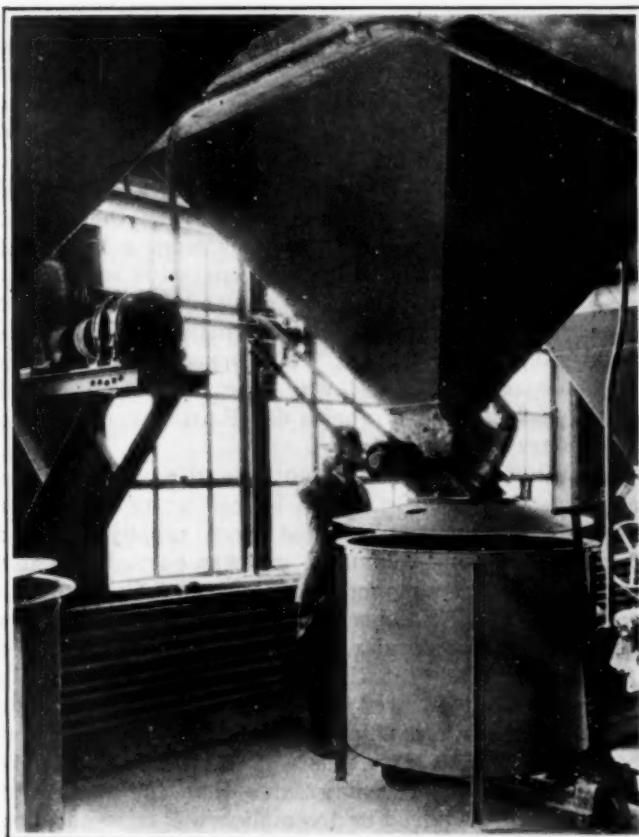
ing of labor, but the dump hopper being enclosed and ventilated dust is entirely eliminated. Thus from press to dump hopper, the material is moved quickly and in large quantities with absolute plant cleanliness.

From the dump hopper, the arsenate of lead and insecticides pass directly to the pulverizing machines, and then in turn to the 2 automatic packers, 1 for 25 lb. bags and the other for packages of 4 lb. and smaller. Sufficient packing equipment is provided so



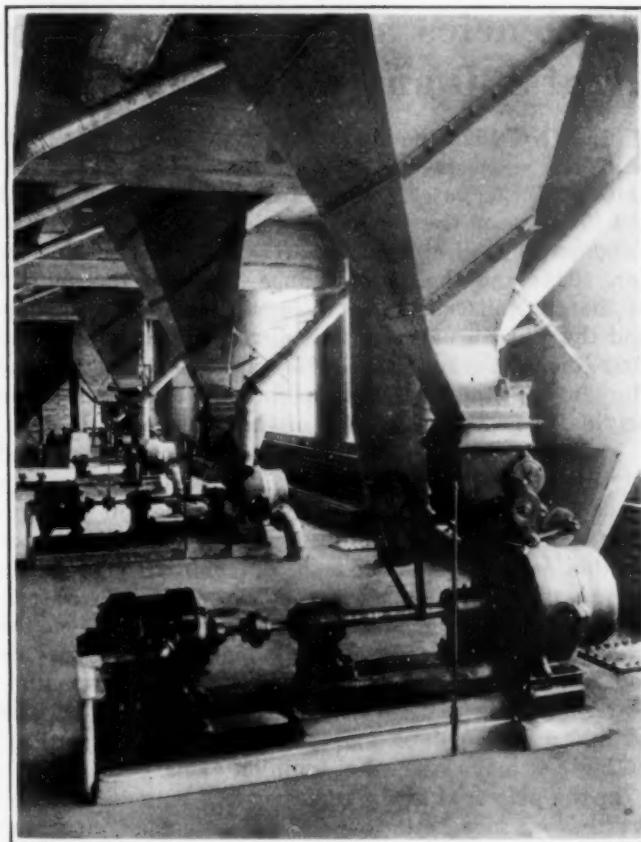
Dumping the Drying Racks

After weighing, the racks are placed in a dump hopper and the entire truck is dumped in one operation



Container for the Crushed Dry Color

After passing through crushing rolls, the dry color goes to large metal containers



Pulverizing Color Material from the Blender

Direct connected to motors running at 3,600 r.p.m., this installation is the first of its type

that the entire output of the plant can, if required, be packed in 4-lb. packages, the required unit quantity for the standard 200-gal. fruit spray equipment. Dry colors are dumped in the same manner, but instead of passing through a pulverizing machine, are passed through crush rolls into metal containers holding from 1,000 to 2,000 lb. A color blender has been designed that mixes from 2 to 4 tons at a charge. The color is discharged from blender into the hopper, from which it passes through the pulverizing machine. These pulverizing machines operate with a 3,600-r.p.m. direct-connected motor, being the first of this type of installation that has been made. By doing all blending and

mixing before pulverizing, it is obviously possible to obtain a much more perfect blending of color and at the same time saving additional operation over first pulverizing and then blending.

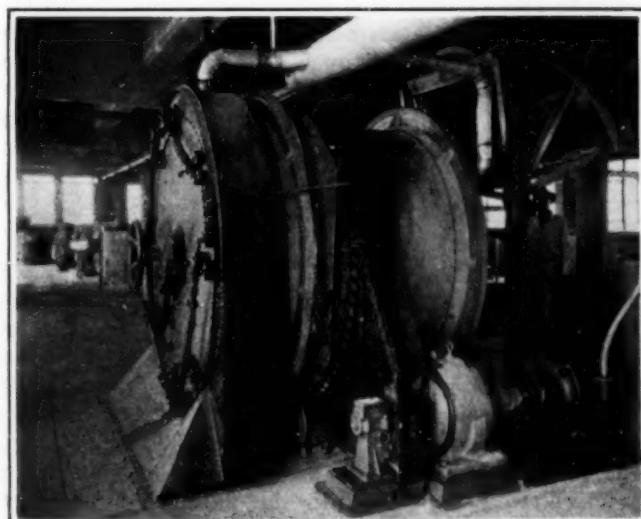
The pulverizing process is completely closed in a metal collection system, replacing the old method of dust bags. At the point of discharge, a separate ventilating suction system handles the dust from packing. In fact, at every point in the plant where dust is created proper ventilation is installed and the entire cleaning of the plant is accomplished with a vacuum cleaning apparatus.

Alcohol from Root Crops

The British Fuel Research Board has just issued a third memorandum on fuel for motor use, with special reference to making alcohol from potatoes, mangolds, and Jerusalem artichokes. These 3 root crops are the only ones which give any promise of commercial availability for industrial alcohol in Great Britain and Ireland.

It is estimated that 1 ton of potatoes will produce 20 gal. of 95 per cent alcohol, so that each £1 which it costs to grow a ton of potatoes is equivalent to 1 shilling per gal. of alcohol for the raw material alone. With mangolds a yield of 8 gal. makes the corresponding cost 2s. 8d. per gal. for raw material alone. With Jerusalem artichokes the yields range from 6 to 30 tons per acre and from 15 to 25 gal. of alcohol per ton of tubers. This indicates much the lowest raw material cost of any of the 3 groups.

The full report is available from His Majesty's Stationery Office, King's Way, London, W. C., for 9d. per copy.



New Type of Color Blender

With this apparatus, 2 to 4 tons of various colors are thoroughly mixed to complete uniformity

Efficiencies and Relative Value of 530 and 600 B.t.u. Gas

DURING 1924 the Detroit Testing Laboratory made tests upon the relative efficiencies in use of 530 and 600 B.t.u. gases. These tests formed the basis of the "Report of the Detroit Testing Laboratory to the Common Council of the City of Detroit," dated November, 1924; and their significance has been the subject of thorough discussion between the Detroit Laboratory and the Bureau of Standards during a period of about four months. In the course of the discussion the Bureau of Standards was permitted to examine the original records of a portion of the tests.

This brief paper is a summary of the results disclosed by the original records. The data used are the data actually observed and recorded by the Detroit Laboratory and unaffected by any theory or assumption or opinion whatever. The basis of comparison between the gases here employed is that chosen by the Detroit Laboratory (all comparative tests were made with the same mechanical setting of all appliance adjustments for each gas). All questions of judgment are eliminated by using general averages, mechanically arrived at, and merely pointing out their significance, without giving conclusions based on opinion alone.

In the principal series of tests, 4.17 pounds of water was heated in a kettle over the "top burner" of a gas range. The temperature interval through which the water was heated varied somewhat, but it was usually from about 70 deg. to 210 deg. F. All results have been corrected (in the same way by both laboratories) to show the amount of gas required to heat from 70 deg. to 212 deg. F. The heating of 4.17 pounds of water over this temperature range is therefore referred to as the "standard test."

Taking the general average of the results of all these tests, 2.36 cu.ft. of gas of 600 B.t.u. perform the service represented by the standard test in 526 seconds. The same service is performed by 2.64 cu.ft. of 530 B.t.u. gas, but 570 seconds is required. If both gases cost 79 cents per thousand cubic feet (the figure assumed in the Detroit Report) the test costs 0.186 cents when performed with 600 B.t.u. gas and 0.209 cents with 530 B.t.u. gas. To do the same work at the same cost, 530 B.t.u. gas would have to be sold at 70 cents per thousand cubic feet and even then, on the basis of comparison chosen by the Detroit Laboratory, much time would be wasted with the 530 B.t.u. gas. If the two gases were sold at the same price per million B.t.u. (the price being that of the 600 B.t.u. gas at 79 cents per thousand), the 600 B.t.u. gas would cost 0.186 cents for the standard test and the 530 B.t.u. gas, 0.184 cents. This makes a difference of 1 cent in 430 operations requiring a total of 63 hours with 600 B.t.u. gas or 68 hours with 530 B.t.u. gas. Thus an actual loss of five hours is involved in saving one cent.

The test data show that many of the settings of the burner were utterly improper for both gases, because they caused a dangerous condition of incomplete combustion which would be at once recognized and eliminated by any experienced representative of a gas or appliance company. If we eliminate the tests made under such conditions from the average, and use only the tests made under conditions approaching those of practical usage (those with the air shutter wide open

and two-thirds open) we find the following relations:

With both gases at 79 cents per thousand cubic feet, the operation involved in the standard test costs 0.185 cents with 600 B.t.u. gas and 0.210 cents with 530 B.t.u. gas. It would cost the same with both gases if the 600 B.t.u. gas were sold at 79 cents per thousand and the 530 B.t.u. gas at 70 cents per thousand, and it would still require 10 per cent more time with the gas of lower heating value. If the gases were sold at the same price per million B.t.u., the operation would cost 0.185 cents and 0.184 cents with 600 and 530 B.t.u. gases respectively. To save one cent with the 530 B.t.u. gas would then require about 1,100 operations requiring 178 hours of actual time, while the same result would be achieved in 161 hours with 600 B.t.u. gas, a sacrifice of 17 hours for one cent.

An oven was heated with 600 B.t.u. gas burned at one rate and with 530 B.t.u. gas burned at two different rates, one which supplied heat more rapidly and one in which the same volume of gas was burned per unit time, but which supplied heat less rapidly than the 600 B.t.u. gas. The observed time-temperature curves were somewhat irregular. Averaging the quantity of gas necessary to heat the oven to each of 9 evenly distributed temperatures in the upper part of the range of oven temperatures employed in practice, we find that the volume of 530 B.t.u. gas was, in the two tests, 17 per cent and 14 per cent greater than the volume of 600 B.t.u. gas required to accomplish the same purpose. The same amount of heat was required to produce the same effect when burning the 600 B.t.u. gas and when burning the 530 B.t.u. gas at a higher rate. When the two gases were burned at the same rate, in cubic feet per hour, about four per cent more heat was required from the 530 B.t.u. gas.

Under every one of the many test conditions employed, the volume of 530 B.t.u. gas required to produce a given result was greater than the volume of 600 B.t.u. gas required for the same purpose. In no case was there an important difference in the amount of heat required to produce the same result. Insofar as this statement differs from the conclusions of the Detroit Testing Laboratory, the difference is caused by unnecessary assumptions introduced by the Detroit Laboratory, the most important of which are clearly shown by the experimental data themselves to be contrary to fact.

In proof of the statements here made, there will be sent to those interested, upon request to the Bureau of Standards, Washington, D. C., a detailed criticism of the Report of the Detroit Testing Laboratory, together with comments upon the same written by both laboratories.

Correction

In *Chem. & Met.* for March, 1925, in an article on "Cost of Industrial Heating," by D. J. Demorest, there appeared on page 381 a table giving a comparison of the cost of heat, as applied to typical heating operations, for various fuels and for electricity. In this table the cost of gas was given at \$1.75 per 1,000 cu.ft. This was in error. The figure should have been \$0.75 per 1,000 cu.ft., as appeared in the author's manuscript. The latter figure will be found to check with the figures given for cost per 100,000 B.t.u. The remainder of this table is correct.

References to Recent Work on Nitrocellulose Lacquers

By F. M. Crawford

Department of Research Information,
Commercial Solvents Corporation

IN CONNECTION with the study of cellulose ester lacquers by the Research Information Department of the Commercial Solvents Corporation, much literature on the subject of lacquers has been assembled and studied. Timely and authoritative information upon this subject is so difficult for the newcomer in the industry to obtain, that it is thought that the references presented herewith will possibly be useful to those who do not have the time or bibliographical resources for an extensive search.

Although some valuable information on pyroxylin lacquers was published between 1900 and 1919, the "new lacquer industry" may fairly be said to be less than 5 years old. The present list is intended to provide a key to all literature published since 1919 and pertinent to the materials, compounding, application, and testing of nitrocellulose lacquers. A few citations to valuable works published prior to 1919 are included also.

Laboratoriums Buch f.d. Lack u. Farbenindustrie, *H. Wolff*.

Synthetic Organic Compounds, *S. P. Schotz*. Ernest Benn, Ltd., London.

Nitrocellulose Technology, 2 vols., *E. C. Worden*. D. Van Nostrand Co., New York, 1911.

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Handbook on Japanning for Ironware, Tinware, Wood, etc., *W. N. Brown*.

Oils, Pigments, Paints, Varnishes, etc., *R. H. Truelove*. Sir Isaac Pitman & Sons, Ltd., London.

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Cellulose Varnishes, *F. Sproxton*. Ernest Benn, Ltd., London.

British Standard of Reference for Aircraft Dope and Protective Covering (Including Specifications for Each Ingredient and Method of Application).

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Die Fabrikation der Kopal, Terpentina und Spirutus-lake, *L. E. Andres*. Leipzig, 1909.

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Handbuch der Lack und Firnis-Industrie, *F. Seligman* and *E. Zieke*.

Die Fabrikation der Lacke, Firnisse, Buchdrucker-Firnisse und des Siegellackes, *E. Andres*. 7th Edition Revised.

Quick Drying Lacquer Coatings, *H. A. Gardner*. U. S. Paint Mfrs. Assoc., Circ. No. 65.

Phenomena in Paints and Varnishes Induced by Colloidal

Reactions, *H. A. Gardner*. U. S. Paint Mfrs. Assoc., Circ. No. 200.

Suggestions Regarding Some Pyroxylin Coating Materials, *H. A. Gardner*. U. S. Paint Mfrs. Assoc., Circ. No. 203.

Suggestions of a Lacquer Coating Solvent, *H. A. Gardner*. U. S. Paint Mfrs. Assoc., Circ. No. 209.

Speed of Evaporation of Solvents from Pyroxylin Lacquer Coatings, *H. A. Gardner* and *H. C. Parks*. U. S. Paint Mfrs. Assoc., Circ. No. 218.

Ethyl Lactate, *H. A. Gardner*. U. S. Paint Mfrs. Assoc., Circ. No. 225.

Accelerated Testing Cabinets, *H. A. Gardner*. U. S. Paint Mfrs. Assoc., Circ. No. 226.

Examination of Pyroxylin Lacquer Coatings, *H. A. Gardner*. U. S. Paint Mfrs. Assoc., Circ. No. 227.

A Study of the Hardness of Varnish and Other Films, *H. A. Gardner* and *H. C. Parks*. U. S. Paint Mfrs. Assoc., Circ. No. 228.

The Swinging Beam Method of Testing Varnish Films, *P. H. Walker* and *L. L. Steele*. U. S. Paint Mfrs. Assoc., Circ. No. 229.

Physical Tests on Some Commercial Varnishes, *H. A. Gardner* and *H. C. Parks*. *Am. Arc.*, 1924, vol. 126, pp. 523-4.

Cellulose Nitrate Dope, *H. A. Gardner*. Papers on Paint and Varnish, p. 327.

Suggestions Regarding Some Pyroxylin Coating Materials, *H. A. Gardner*. *J. Soc. Dyers and Colourists*, 1924, vol. 40, p. 241.

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The Falling Sphere Viscosimeter, *W. H. Gibson* and *L. M. Jacobs*, *J. Chem. Soc.*, 1920, vol. 117, pp. 473-8.

Stress-Strain Measurements on Films of Drying Oils, Paints and Varnishes, *H. A. Nelson*. *Proc. A. S. T. M.*, 1921, vol. 21, pp. 1111-38.

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To be continued in an early issue.—EDITOR.

Absorption of Ammonia in Towers

Development of Theory, Practical Applications and Summary of Experimental Work

By O. L. Kowalke, O. A. Hougen and K. M. Watson

Professor, Assistant Professor and Fellow Respectively of Chemical Engineering, University of Wisconsin

THE dual film theory recently advanced by Whitman and Keats (*J. Ind. Eng. Chem.*, 1922, vol. 14, p. 186) is based on the assumption that practically the entire concentration gradient in both air and liquid phases takes place in adjoining thin fluid films at the contact surface. Any material that is passed from one phase to the other passes through these 2 films by diffusion. The resistances to diffusion then, are the factors that control the rate of transfer. If the film resistances were zero, the rate of diffusion would be infinitely great, providing a concentration difference were maintained. Furthermore, at any one concentration difference, the rate of transfer, per unit area of contact, would be dependent on the combined resistances of the 2 films. Thus it may be said that the transfer coefficient of a tower, per unit area of contact, is dependent upon the factors influencing the rate of solute diffusion through the 2 mediums.

The principal factors that control the resistance to diffusion offered by either medium are the viscosity of the medium and the degree of agitation maintained in it. Viscosity is dependent upon temperature. Agitation is controlled primarily by the relative velocities of the two fluids and their mutual effect upon each other. Thus the rate at which the liquid flows over the packing will influence the agitation in the liquid film, and the degree of agitation in the gaseous phase will be affected by the rate at which the air is forced through the packing. There would be an additional effect in each phase due to the mutual action of the 2 fluids moving in contact with each other. Thus the motion of the gas would exert some influence on the agitation at the surface of the liquid and, conversely, the motion of the liquid would exert an influence on the agitation of the gas at the surface of contact.

Taking these effects into consideration, the general equation for the ammonia transfer coefficient on the basis of unit area of contact may be written

$$\frac{1}{k} = \frac{1}{f(G,L)} + \frac{1}{f'(L,G)} + M$$

where the first member of the right hand side of the equation represents the resistance of the gaseous film and the second member that of the liquid film, and

$f(G,L)$ = separate and mutual effects of fluid velocities on gas film,

$f'(L,G)$ = the separate and mutual effects of fluid velocities on liquid film,

k = transfer coefficient per unit of active contact area,

M = conductance of gaseous film when both flow rates are zero,

M = conductance of liquid film when both flow rates are zero.

The above expression indicates a relationship between the transfer coefficients per unit active area and the controlling factors in ordinary practice, with the exception of temperature variation. In order to change the

expression into terms of the transfer coefficient per unit volume of tower packing, each side of the above equation must be divided by the effective area of contact per unit volume.

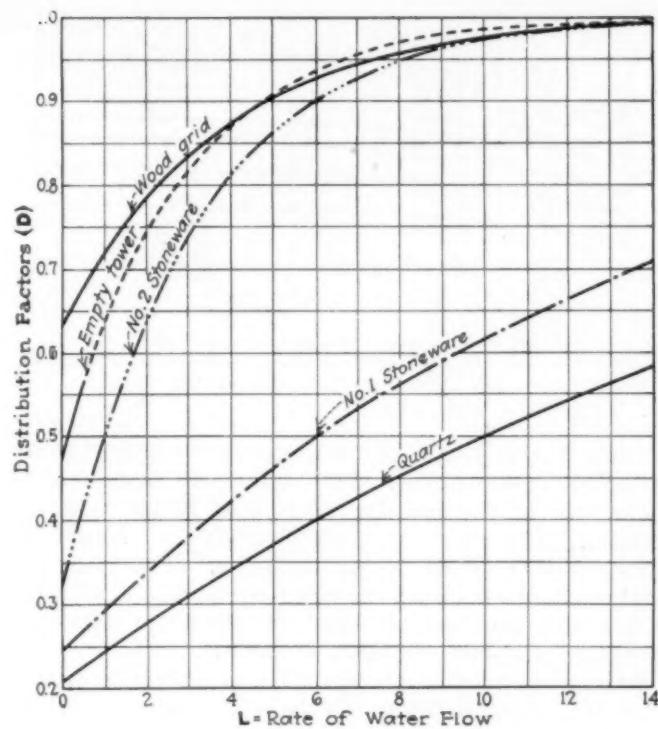
To formulate an expression for the 2 complex functions in the above equation, it is necessary first to determine the relative values of the 2 film conductances at zero fluid velocities, namely, M and N . One means of determining these relative values is to study separately the rate of absorption of ammonia in the presence of both films and then when only 1 film is present. This was done by studying the rate of absorption of pure ammonia gas, and then studying the rate of absorption of ammonia from an ammonia-air mixture with no agitation.

The first problem, the rate of absorption of pure ammonia, was determined by filling a perfectly dry 100 c.c. burette, stoppered with a glass cock at each end, with pure dry ammonia gas. Water was then admitted through the lower stop-cock and observation made of the time required to absorb all the ammonia and completely fill the burette with water. At first, pure ammonia gas under 1 atmosphere was used. It was found that the rate of absorption of ammonia was practically instantaneous. In this case the gas film was negligible and the driving force was practically constant at 760 mm. pressure.

In order to have a measurable rate of absorption, it was necessary to reduce the pressure of the ammonia in the burette to 10 mm. and then to measure the rate of absorption, by admitting water, also maintaining the water under a constant pressure of 10 mm. This reduced pressure was obtained by partially evacuating the burette and the water-leveling column. In this way the rate of absorption was sufficiently slow to be measured accurately. The driving force effecting absorption was practically constant at 10 mm. The value of the ammonia transfer coefficient could then be calculated on the basis of 1 sq.ft. of surface by calculating the weight of ammonia absorbed per min. per sq.ft. per mm. difference in pressure. This represents the transfer coefficient of the water film alone, as there was practically no gas film present.

The next step was to compare this rate of absorption with the rate when both air and water films were present. The manner of procedure in this case was to make up an ammonia-air mixture about 40-60 by volume and fill the dry burette with a mixture of dry gas. Both gas and water remaining relatively stationary, it was found that the rate of absorption for ammonia was surprisingly slow. In fact, the rate was found to be practically negligible compared to that when water and ammonia alone were present.

The rate of ammonia absorption in the absence of air was found to be 0.1172×10^{-3} lb. per sq.ft. per min. for an average vapor pressure difference of 1 m.m. On the basis of 30 sq.ft. of exposed area per cu.ft. of tower packing, this would correspond to a value of 3.51×10^{-3} for "ka". The average transfer coefficient of ammonia from the air mixture was calculated to be 0.00213×10^{-3} lb. ammonia absorbed per min. per sq.ft. of water surface. Hence on the basis of 30 sq.ft. of water surface per cu.ft. of packing, this would correspond to a value for the transfer coefficient of 0.069×10^{-3} . It is interesting to compare this latter value for the transfer coef-

Fig. 13—Distribution Factors with Variable Water Flow ($G = 4$)

ficient with the values determined experimentally at zero rates of liquid and gas flow in the packed tower.

No. 1 stoneware	0.06×10^{-3}
Quartz	0.07×10^{-3}
Wood grid	0.09×10^{-3}

The foregoing data indicate that the resistance of the air film is at least 50 times that of the water film, even at concentrations of 40 per cent ammonia. In other words, the experimental value of the ammonia transfer coefficient practically represents the transfer coefficient of the air film alone and was so assumed in subsequent formulations.

Introduction of Distribution Factor—Since from experimental observations it is seen that the water flow has a marked effect upon the transfer coefficients, it is obvious that this effect must either be to increase the rate of diffusion in the air, or to alter the effective

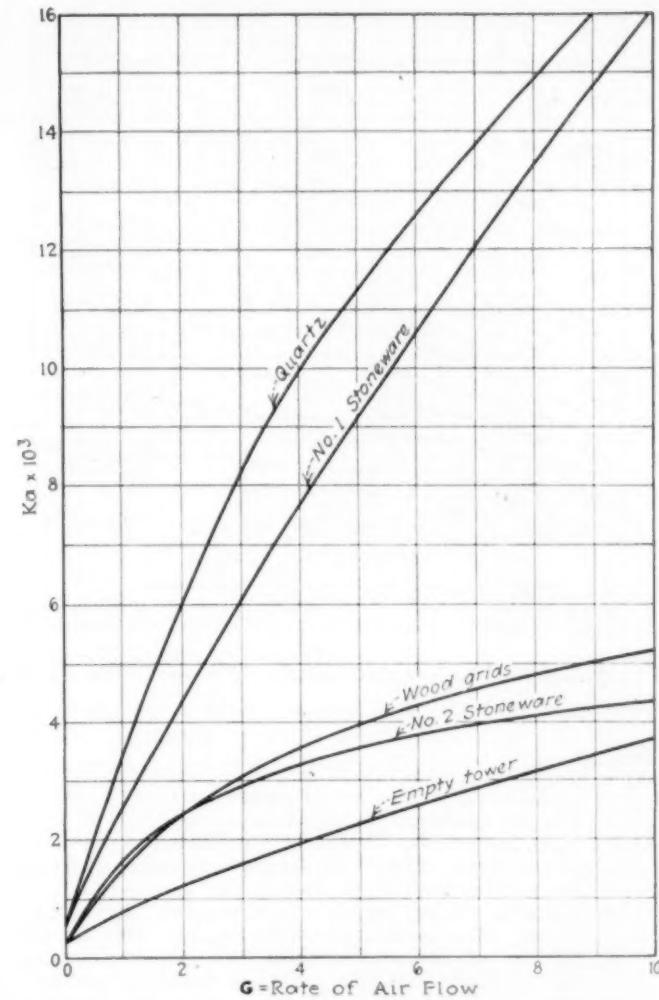


Fig. 14—Diffusion Factors of Ammonia Transfer Coefficients at Maximum Water Distribution and Variable Gas Flow

distribution of the water and thus change the actual active area of contact. The latter assumption seems to be by far the more reasonable. It is questionable whether at slow rates the water discharged from a half inch pipe could maintain a permanent, uniform and flowing film over vertical surfaces contained in a cross section of 1.39 sq.ft. Especially at low rates it is hard to conceive of water distributing itself uniformly and continuously over large vertical surfaces in a thin moving film, even though the entire surface be wet. Furthermore, the water flows down under the influence of gravity and at a practically constant linear velocity regardless of mass velocity so that the effect upon agitation of air film would be nearly constant and not an exponential function, as found experimentally. For these reasons it was concluded that the most reasonable method of expressing the mathematical relationships of

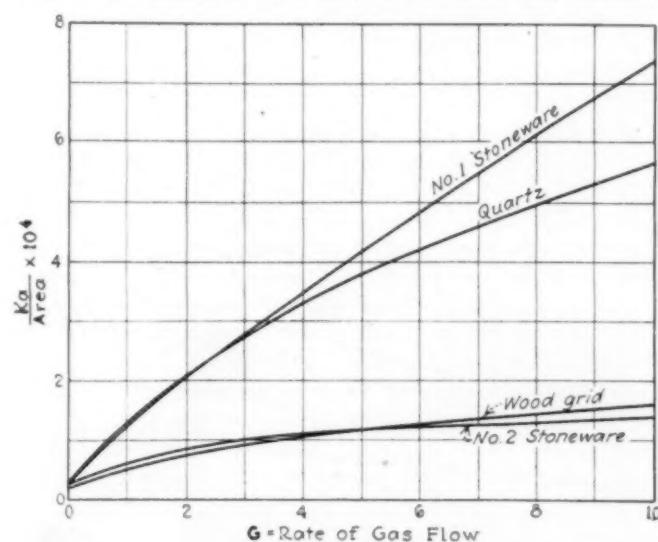


Fig. 15—Ammonia Transfer Coefficients per Sq. Ft. of Total Packing Surface at Maximum Water Distribution and Variable Rate of Gas Flow

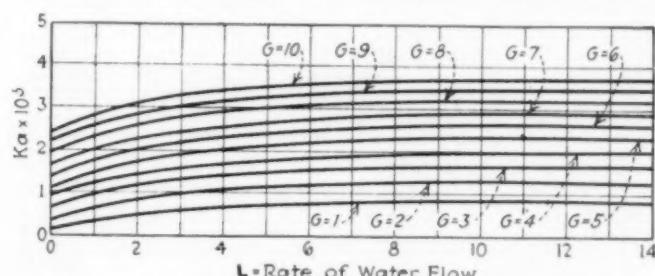


Fig. 16—Ammonia Transfer Coefficients, Calculated for Empty Tower

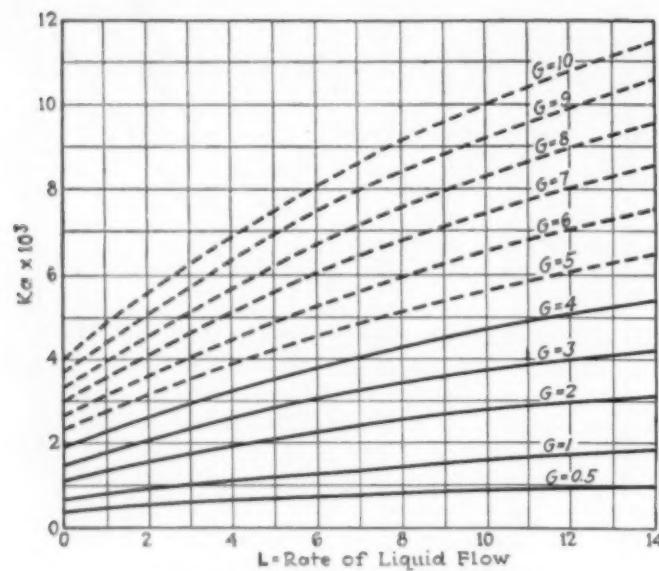


Fig. 17—Ammonia Transfer Coefficients
Calculated values for No. 1 stoneware packing. Extrapolated range in broken lines, experimental range in full lines.

the ammonia transfer coefficients was in terms of 2 factors. Thus,

$$ka = D \times A$$

where

D = the distribution factor, which represents the ratio between the actual active wetted surface of contact and the maximum active surface attained at high water velocities. D is thus primarily a function of the water velocity, approaching a value of unity at high rates of water flow.

A = diffusion factor, which represents the rate of diffusion of ammonia through the air film at the surface of contact, expressed in lb. of ammonia absorbed per min. per cu.ft. of packing, per mm. mean vapor pressure difference, when the distribution factor is equal to unity.

The surface exposed per unit volume of packing is not identical with the maximum active area of contact, and whereas the entire surface within the tower is wetted, only that portion is active in the absorption of ammonia over which a steady stream of water is flowing. The diffusion factor is in reality the transfer coefficient of the air film alone when the distribution factor is unity. The distribution factor is primarily a function of the liquid velocity, approaching unity at high rates of water flow. It is also reasonable to believe that this distribution will also be a function of the gas velocity, increasing with the rate of flow. One type of equation expressing this form of relationship is

$$D = 1 - K_1 10^c L$$

where

D = distribution factor,

L = rate of water flow,

c = constant with a negative value,

K_1 = a function of the rate of gas flow to be experimentally determined.

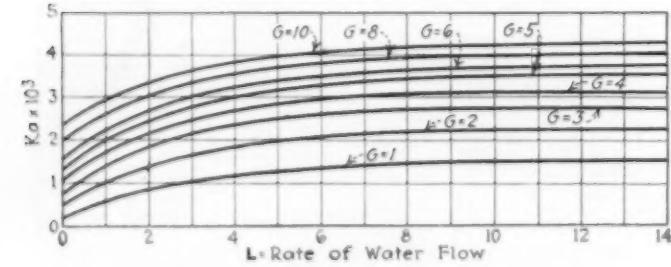


Fig. 18—Ammonia Transfer Coefficients
Calculated values for No. 2 stoneware packing, experimental range, $G = 0$ to 4; extrapolated range, $G = 4$ to 10.

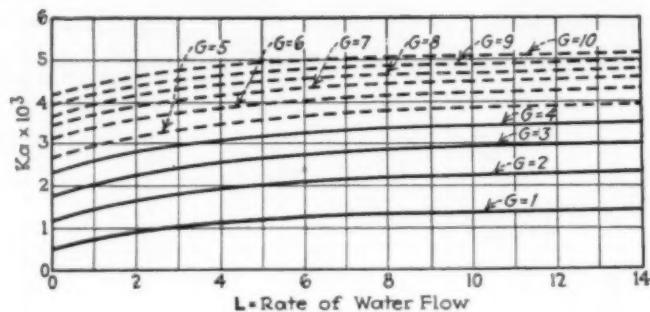


Fig. 19—Ammonia Transfer Coefficients
Calculated values for wood grid packing. Extrapolated range in broken lines, experimental range in full lines.

The diffusion factor "A" is determined by the degree of agitation of the gas. The factor "A" is therefore a function of the gas flow as well as of the type of packing. The effect of water flow on the degree of agitation is believed to be negligible. The form of expression which shows the relation of "A" to the rate of gas flow can best be determined for the different packings by purely empirical methods.

Application of Distribution Theory to Simple Spray Chamber (Empty Tower)—A special analysis of the conditions existing when the empty tower is acting as a simple spray chamber is necessary before the above relationship can be applied directly. It is apparent that in this type of absorption tower, all the water surface would be active. However, the actual distribution of the water over the entire cross section of the tower is dependent upon the operation of the spray nozzles which are designed to give uniform distribution only at 1 water rate. For either lower or higher rates than the normal, the distribution will be altered. Therefore in the application of the above formula to the simple spray chamber, the distribution factor is intended to represent the operation of the spray nozzles at varying water rates. At zero flow, there would still be an effective surface of contact due to residual moisture on the inside surface of the tower. The calculated coefficients for an empty tower are shown in Fig. 16.

It is not deemed expedient to present in a paper of this character the actual method of formulating the mathematical equations for the transfer coefficient, "ka" and the evaluation of the constants in this equation. These equations are as follows:

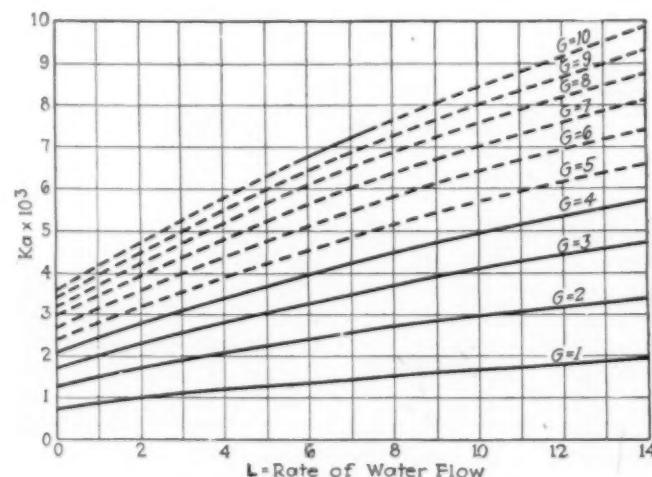


Fig. 20—Ammonia Transfer Coefficients
Calculated values for quartz packing. Extrapolated range in broken lines, experimental range in full lines.

Quartz packing,

$$ka = D.A = \left[1 - 0.79 \left(10^{-0.02L} \right) \right] \left[\frac{G}{31G + 294} + 0.00033 \right]$$

Empty tower, simple spray chamber,

$$ka = D.A = \left[1 - \left(\frac{1}{0.2G + 1.0} \right) 10^{-0.02L} \right] \left[0.00074 G^{0.02} + 0.00007 \right]$$

No. 1 stoneware packing,

$$ka = D.A = \left[1 - (0.755) 10^{-0.02L} \right] \left[0.00024 + 0.0023 G^{0.02} \right]$$

No. 2 stoneware packing,

$$ka = D.A = \left[1 - \frac{10^{-0.02L}}{0.115G + 1.02} \right] \left[\frac{G}{185G + 510} + 0.0001 \right]$$

Wood grid packing,

$$ka = D.A = \left[1 - \frac{10^{-0.02L}}{1.1 + 0.4G} \right] \left[\frac{G}{135G + 640} + 0.00016 \right]$$

Comparison of Distribution Factors—It is interesting to compare the distribution factors separately for the various types of packings, as these factors determine in part the rates and efficiencies of absorption. From Fig. 13 it will be seen that the distribution factors for the wood grids, the empty tower, and the No. 2 stoneware rapidly approach unity. Assuming 0.90 as being the optimum distribution factor, this being based on the economic considerations of the cost of water and the reclamation of the ammonia, the optimum rate of water flow for these packings would be about 6.0 lb. per sq.ft. per min.

Comparison of Diffusion Factors—It is also interesting to compare the diffusion factors for the various types of packings when the distribution factor is unity, that is, when the maximum active surface of contact is presented. This is shown graphically in Fig. 14. It will be readily seen that quartz and No. 1 stoneware packing are far superior to any other type in effecting a rapid diffusion of the solute gas. In comparing quartz and No. 1 stoneware it should furthermore be stated that the apparent superiority of quartz is offset by the much greater expenditure of power required in blowing air through it.

Finally, a comparison has been made of the rates of diffusion for the various packings for the range where the distribution factor is unity, on the basis of each sq.ft. of total surface of the packing, Fig. 15. It is apparent from this comparison that no relation whatsoever exists between the total surface of the packing and the values of ammonia transfer coefficients.

The calculated and experimental data included in this series possess considerable practical value both in the design and in the operation of absorption apparatus. Two simple illustrations of the practical use of these data are presented herewith.

An absorption tower is operated under the following conditions:

Maximum gas production 300,000 cu.ft. per hr., density of air 1.0, temperature of gas delivered to tower 80 deg. F., pressure of gas delivered to tower 30 in. Hg., water vapor pressure in gas 0.5 in. Hg., ammonia content of gas 2,000 grains per 1,000 cu.ft., temperature of liquor

leaving the tower 80 deg. F., concentration of liquor entering the tower 0.00 per cent NH₃.

(a) Design a tower for the removal of 99.5 per cent of the ammonia from the incoming gas, producing a liquor containing 0.5 per cent of ammonia, temperature 80 deg. F., and using a wood grid packing.

Computing the weight of dry gas delivered per minute,

$$\frac{300,000}{60} \times \frac{30 - 0.5}{460 + 80} \times 1.325 = 362 \text{ lb.}$$

Total weight of ammonia per minute,

$$5 \times \frac{2,000}{7,000} = 1.43 \text{ lb.}$$

Partial pressure of ammonia in incoming gas,

$$\frac{1.43}{362} \times \frac{29}{17} \times 29.5 \times 25.4 = 5.04 \text{ mm.}$$

Partial pressure of ammonia in outgoing gas,

$$0.005 \times 5.04 = 0.0252 \text{ mm.}$$

Assuming vapor pressure of ammonia in outgoing water = 4.15 mm., then mean vapor pressure difference = $\frac{(5.04 - 4.15) - (0.0252 - 0)}{\ln \frac{5.04 - 4.15}{0.0252 - 0}} = \frac{0.865}{\ln 35.3} = 0.243$

Weight of ammonia absorbed = $1.43 \times 0.995 = 1.422$.

Total weight of water used per hour,

$$\frac{1,000 \times 1.422}{5} = 284 \text{ lb.}$$

From Fig. 19 it will be observed that the optimum rate of water circulation is about 6.0 lb. per sq.ft. per min. for a wood grid packing. Hence the cross section of the tower should be,

$$\frac{284}{6} = 47.3 \text{ sq.ft. and the diameter} = 7.8 \text{ ft.}$$

The rate of gas flow is then,

$$\frac{362}{47.3} = 7.65 \text{ lb. per sq.ft. per min.}$$

The value of the ammonia transfer coefficient corresponding to $G = 7.65$ and $L = 6$ is found from Fig. 19 to be 0.0045. The volume of the tower required will therefore be,

$$\frac{1.422}{0.0045 \times 0.243} = 1,300,$$

and the height of the tower will be,

$$\frac{1,300}{47.3} = 27.5 \text{ ft.}$$

As a reasonable factor of safety, the height should be increased at least 25 per cent above this, making the final dimensions of the packing then being about 8x35 ft.

(b) Required to know how much higher the above tower should be built to increase the absorption efficiency to 99.9 per cent. Under these conditions, the mean vapor pressure difference would be,

$$\frac{(5.04 - 4.15) - (0.005 - 0)}{\ln \frac{0.89}{0.005}} = 0.170$$

and the volume of the tower should therefore be,

$$\frac{1.43}{0.0045 \times 0.170} = 1,870 \text{ cu.ft.}$$

which corresponds to a height of 39.5 ft. This shows that to increase the efficiency of absorption from 99.5 per cent to 99.9 per cent the height of the tower must be increased 44 per cent. By making a series of computations and plotting the value of the product saved against the cost of construction and operation, the most economical height of tower can readily be determined.

Summary of Results:

- As the basis for the calculation of experimental data, the equation expressing the variation of the partial pressure of ammonia in aqueous solutions at low concentrations and at various temperatures was derived from free energy considerations. This formula is found to check closely with the limited experimental data available.

2. The mathematical derivation of a suitable expression for the mean vapor pressure difference in an absorption was found, under the conditions of the experimental work, to be the logarithmic mean.

3. An apparatus and procedure have been developed for the determination of ammonia transfer coefficients.

4. Experimental data on the ammonia transfer coefficients of 4 typical packings and of a simple spray chamber have been determined for from 0 to 14 lb. of water per min. per sq.ft. of total cross section and for air rates from 0 to 4 lb. per min. of dry air per sq.ft. of total cross section.

5. It has been found experimentally that for all practical purposes the resistance of the liquid film is negligible as compared to that of the air film.

6. On the basis of this experimental work, the theory is advanced that the rate of absorption is determined primarily by the rate of diffusion of the ammonia through the gas. It is believed that this same principle applies to the absorption of any gas in a liquid when a strong chemical reaction takes place. In such cases the rate of absorption is controlled by the rate of diffusion, through the gas phase, and hence should vary inversely with the square root of the respective molecular weights of the solute gas and inversely with the viscosity of the solvent gas.

7. The theory of absorption has been extended as follows: The rate of absorption of ammonia and similar gases is believed to be controlled primarily by 2 factors, that is,

$$ka = (D) \times (A)$$

where D = water distribution factor, and is equal to that fraction of the maximum exposed surface of contact that is actually active, under given conditions. A distinction is made here between the total exposed surface of the packing, the maximum active surface, and the surface actually active under particular conditions. This distribution factor for any given type of packing is dependent primarily upon the rate of liquid flow and secondarily upon the rate of gas flow; it approaches unity at high rates of liquid flow. A = gas diffusion factor, which expresses the rate of diffusion of the solute gas through the solvent gas when the distribution factor is unity.

8. On the basis of this theory, mathematical equations have been formulated expressing the relationships between the ammonia transfer coefficients and the variable rates of flow for gas and liquid. The distribution and diffusion factors have also been expressed mathematically in terms of these variables.

9. A few experimental tests of the effect of temperature variations indicate that the ammonia transfer coefficients decrease with an increase in the temperature of the gas in about the same order of magnitude as the corresponding increase in the viscosity of the gas. It is believed that the temperature of the water has little effect upon the ammonia transfer coefficients except in so far as it controls the temperature of the air.

10. It has been determined that the actual total surfaces of the tower packings bear no apparent relation to the rate of absorption. That type of packing is most efficient which produces the greatest agitation of the air in direct contact with the water surface and which gives the highest distribution factor. The positions of the surfaces in the packing rather than the area exposed control the rates of absorption.

Internal Combustion Boiler

At a joint meeting of the Institution of Chemical Engineers and the Chemical Engineer Group of the Society of Chemical Industry, held in London on Feb. 11, 1925, Oscar Brunler, son of the inventor, described an internal-combustion boiler.

In this boiler a flame of burning liquid fuel is submerged in water, the steam so generated being collected in a central reservoir. It has been found that every kind of liquid fuel will burn in water as long as the amount of air or oxygen supplied is sufficient to ensure complete combustion. Liquid hydrocarbons of a specific gravity between 0.8 and 1.2 have been used, and include tar oil from Belgium, coal tar from Germany and Astatki from Baku. More than 60 different liquid fuels have been successfully used.

The fuel and the air for its combustion are supplied to the burner under a pressure which barely exceeds that of the steam. Before starting, the valve between the boiler and the water reservoir is closed and the level of water in the burner kept below the lower mouth of the burner. The flame is then ignited at a primer, which heats up the main burner. When this is sufficiently heated, it is turned on and its flame burns in the steam generator. The valve to the water reservoir is then opened and the water level in the generator allowed to rise to the middle of the flame.

The temperature in the center of the flame is approximately 1,800 deg. C., which diminishes toward its periphery. Since a permanent stream of burning gas has to pass the fall in temperature, the CO is all converted to CO₂. Fuel is thus burned more completely than in the open air. The combustion occurs under pressure which ensures complete contact of the fuel with oxygen.

The gases of combustion pass off with the steam to the steam reservoir in the proportion of 60 per cent steam and 40 per cent gas. It is claimed that tests on this boiler have shown evaporation surpassing the theoretical evaporation based on the calorific value of the fuel.

Industrial Chemistry in France

A report issued recently by M. Patart, inspector general of powders and explosives in France, gives the position of the country with respect to the important part which the chemical industries play therein.

Protection is demanded for the entire industry and the proposal made to close the frontiers to all chemical products which can be produced at home for a period of 3 years. The idea has opposition, but the authority quoted considers that it is indispensable nevertheless, arguing that French producers should study foreign advanced methods wherever it was known that pre-eminence was a dominant feature in any particular branch of the foreign industry. He argued further for combinations and cartels that collectively would be able to combat foreign competition which the lone manufacturer might not be able to do by himself so long as he was engaged in internecine competition. The appeal was further made to the public to purchase no foreign products where a French product of a similar nature was available. The prospect of France becoming an essentially high tariff country in all that applies to industrial chemistry is growing daily more and more apparent.

Recent Legal Decisions

Digest of typical cases decided in high courts, illustrating principles of law applied to business transactions

BREACH OF ORAL AGREEMENT TO MAKE A WRITTEN CONTRACT NOT SUFFICIENT BASIS FOR RECOVERY

In this case the plaintiff Deutsch alleged that he had made an oral agreement with the president of the Textile Waste Merchandising Co. to make a written contract with him employing him as manager for five years at a stipulated salary plus a percentage of the profits. After the plaintiff had assisted in forming the corporation and bringing in business for a few weeks he was discharged without having received the written contract. He then sought to recover a percentage of the profits which he would have received under the written contract. The Appellate Division of the N. Y. Supreme Court held, however, that the complaint was insufficient as it was an attempt to recover, on an alleged breach of oral contract to give a written contract, damages that would be recoverable if the written contract had been in force.

SELLER MAY NOT RECOVER DAMAGES FOR BUYER'S REFUSAL TO ACCEPT GOODS SHIPPED PRIOR TO TIME NAMED IN SALE CONTRACT

During the War defendant Kahn bought from plaintiff Winter 5 tons of tin to be shipped from China in October, 1918. The contract provided that if the United States should declare an embargo the contract should be suspended until the embargo was lifted. Subsequently the War Trade Board revoked all licenses to import tin from China after October 20, 1918, whereupon the plaintiff offered tin shipped in September, 1918, instead of October as provided in the contract. The defendant refused to accept and the plaintiff sought to recover damages for the buyer's refusal to accept the goods. The Appellate Division of the N. Y. Supreme Court held that the plaintiff was not entitled to recover damages. In the absence of a waiver by the buyer, the tender of goods shipped before the time specified in the contract is not a good tender and the buyer may insist upon the goods specified in the contract. The embargo laid by the government did not give the plaintiff the right to tender September tin in place of October tin because the contract had specifically provided for such an eventuality.

OWNERSHIP OF TRADE MARKS BASED WHOLLY UPON ADOPTION AND USE

In the case of Macauley vs. Malt-Diastase Co., the plaintiff had used the word "Liberty" as a trade mark on malt extract, early in March, 1919. The Malt-Diastase Co. first used the mark on a shipment of goods in interstate commerce on March 29, 1919. The Malt Co. contended that it was the first to use the trade mark in interstate commerce, which it regarded as essential to the right to register the trade mark. The Court of Appeals of the District of Columbia decided, however, that the plaintiff Macauley was entitled to register the trade mark because the ownership of a trade mark is based upon adoption and use, whether

in interstate or intrastate commerce, or both. Macauley's prior use of the trade mark had made him the owner thereof, and ownership is a condition precedent to registration.

CARRIER LIABLE FOR GOODS DESTROYED BY FIRE AFTER THEY HAD BEEN DAMAGED IN SHIPMENT AND RETURNED TO OWNER FOR REPAIR

In this case the Curtis Tire & Rubber Co. made a shipment of automobile tires via the Goodrich Transit Co. The tires were damaged enroute and under special agreement were returned to the plaintiff for reconditioning and repair, after which they were to be reshipped in accordance with the original contract. The original bill of lading was never given up. While the tires were still in the possession of the owners for repair they were destroyed by fire and in a subsequent suit to recover the loss the Supreme Court of Michigan decided that although the tires were actually in the possession of the owner when destroyed, under the special agreement they were constructively in the possession of the defendant carrier, which must stand the loss by fire.

COMMON LAW ARBITRATION AWARD NOT ENFORCEABLE WHEN ARBITRATORS EXCEED THEIR JURISDICTION

In the case of Christenson vs. Cudahy Packing Co. the District Court of Appeals in California reversed the judgment in favor of the plaintiff. The arbitration award had been made in favor of the seller against the buyer, but the arbitrators had failed to submit to the buyer a copy of the seller's statement of fact and proceeded to make an award even though no reply to the seller's statement had been received from the buyer. In the appeal the Court held that the arbitrators had exceeded their jurisdiction and that the award made in such circumstances would not support a judgment.

LEGALITY OF LICENSE AGREEMENTS AND AGENCY CONTRACTS FOR DISTRIBUTION OF TUNGSTEN LAMPS

For the purpose of distributing incandescent electric lamps the General Electric Co. contracted with a large number of agencies. All rights and burdens of ownership remained with the General Electric Co. until the lamps were sold to consumers by the agents, who were required to guarantee the collectability of their customers' accounts and to remit when due whether collection had been made or not. The United States contended that this method of distribution constituted a violation of the Sherman Anti-Trust Act. The government also contended that the license agreement between the General Electric Co. and the Westinghouse Co., whereby the latter was licensed to manufacture and sell lamps at prices to be fixed and maintained by the licensor, was illegal. The U. S. District Court, northern district of Ohio, held that the contention of the government was incorrect in both matters. Although a manufacturer may not, after selling or parting with his product, tie up jobbers and retailers with resale price-fixing agreements, it does not follow that he may not market the product himself through his employees or bona fide agents, even though by this method he may realize advantages which he might not lawfully realize by fixing resale prices after he had parted with the title. It was also held that the license agreement with

the Westinghouse Co. did not violate the Anti-Trust Act. The license agreement was not an attempt to fix or control prices after the article covered by the patent had been sold.

**USE OF INFRINGING TRADE MARK CAN BE ENJOINED
WITHOUT PROOF OF ACTUAL DAMAGE**

The Ford Motor Co. sought to enjoin C. N. Cady Co., Inc., from using the name "Cadyford" in connection with a marine engine manufactured and sold by it, part of which was a Ford gasoline engine used in motor vehicles. The N. Y. Supreme Court held that the plaintiff was entitled to an injunction and expressed the opinion that in seeking an injunction it was not necessary for the plaintiff to show that any person had actually been deceived by the defendant's acts, nor to establish a guilty knowledge or intent to defraud on the part of the defendant. The trade mark complained of need not be an exact duplicate of the original. The test is whether it is so similar as to deceive careless people. Nor need the plaintiff show proof of actual damage; it is the likelihood of injury which may be prevented.

**CALCULATION OF PROFITS AND DAMAGES RESULTING
FROM INFRINGEMENT OF PATENTS**

In the case of Merrell-Soule Co. vs. Powdered Milk Co. the Master declared what he regarded as profits derived from the defendant's infringement of the plaintiff's process of converting milk into a dry powder soluble in water, and also what he regarded as a proper award of damages on a basis of reasonable royalty. The U. S. Circuit Court of Appeals, 2nd Circuit, decided, however, that as there were no profits the award for the same was erroneous. In estimating the damages the Court considered what a reasonable man, who wished to go into the business in hope of making a reasonable profit, would be willing to pay for the use of a necessary step which, however, was only part of the whole operation of making powdered milk.

In another case the Standard Scale and Supply Co. had been found guilty in infringing the Crobb Concrete Machinery Co. patents on charging and discharging devices on concrete mixers. On analyzing the Master's report awarding profits and damages growing out of the manufacture and sale of concrete mixers equipped with the devices in question, the U. S. Circuit Court of Appeals, 7th circuit, held that in case of partial confusion or commingling of profits, the award should extend no further than the actual confusion or commingling permits.

**SALE AT AUCTION RENDERED VOID BY SECRET
EMPLOYMENT OF BIDDER TO ENHANCE
THE PRICE**

In the case of Cerreta vs. Costello the plaintiff attended an auction sale of the defendant's property and bought a piece of property for \$12,500. After making a payment and signing the terms of sale, he discovered that the auctioneer had secretly engaged one Cava to bid the property up to \$12,250. The plaintiff then sued to recover his advance payment. The Appellate Division of the N. Y. Supreme Court held that he was entitled to recover, inasmuch as a sale at auction to be legal must be a bona fide offer by the owner to sell his property to the highest bidder, and the secret employment of "puffers" for the purpose of enhancing the price renders the sale void. It was

immaterial whether the defendant knew the conditions, because an auctioneer is the owner's legal agent.

**CONSTRUCTION OF CONTRACT CLAUSE REQUIRING
SHIPMENT IN SPECIFIED MONTH**

The National Importing & Trading Co., Inc., made a contract with E. A. Baer & Co. whereby it sold and Baer bought certain cases of albumen to be delivered f.o.b. Chicago. The contract provided "shipment from the Orient, 75 cases in April, 50 cases in May and 100 cases in June, 1920." It appears that on March 31, 1920, the National Co. placed 100 cases on board a steamship bound for Seattle, the steamer leaving port on the following day, April 1. On May 5, 100 more cases were placed on board a steamship which left port on May 6. Baer subsequently refused to accept the goods on the ground that the contract had been breached by putting the first instalment of goods on board on March 31, 1920. The National Co. then brought suit for performance of contract by Baer, and the Appellate Court of Illinois, First District, decided that the plaintiff was entitled to recover. The defendant's contention was not applicable because the point of shipment was indefinitely fixed as "from the Orient," and under such circumstances the intention of the parties could only be that the statement of time of shipment would give an indefinite and general idea of the time of arrival. Further, the provision of the time of shipment should be construed as meaning that the albumen should be placed upon ships that would begin their respective voyages in the months named, and not as referring to the times when the albumen was actually placed on ships.

RUST PROOFING PROCESS PATENTS SUSTAINED

In the U. S. District Court in Detroit, Judge Tuttle held that the Ford Motor Co. had infringed the patents of the Parker Rust-Proof Co. on its process for preventing the corrosion of iron and steel. The suit was started by the Parker Rust-Proof Co., September, 1921, and testimony was taken for about 40 days in 1924 and 1925. The court has directed William S. Sayres, Jr., Master in Chancery, to hold hearings to determine what damages the Ford Motor Co. shall pay the Parker Rust-Proof Co.

**National Industrial Conference Board
Reports on Trade Associations**

In pursuance of its purpose of scientific inquiry into the major economic problems affecting industrial conduct, the National Industrial Conference Board, 247 Park Avenue, New York, undertook a comprehensive survey of the development and present position of public policy in the control of private business organization and practices as embodied in the Sherman Act and its supplementary legislation, generally referred to as the anti-trust laws, and in the court and commission decisions and decrees based thereon.

The work of the board has been published in an elaborate report called "Trade Associations, Their Economic Activities and Legal Status." It is divided into five main parts. Part 1 deals with trade associations and the anti-trust laws, part 2 with the evolution of public policy toward competition and co-operation, part 3 with association activities and the regulation of competitive conditions, part 4 with association activities essentially unrelated to competitive conditions and part 5 with the place of trade associations in the industrial structure.

On the Engineer's Book Shelf

Concerning Intellectual Workers

THE INTELLECTUAL WORKER AND HIS WORK. By William Mac-
Donald. The Macmillan Co., New York. 351 pp. Price, \$2.50.

The author of this somewhat remarkable and most readable volume is a distinguished historical author and journalist, educator and economist, whose viewpoint has been broadened by extensive experience and whose sympathy for the intellectual worker has been molded into concrete form in consequence of what is evidently the most extensive research that has been made to date on the subject.

Almost at random I take a single sentence from the middle of the book to indicate the essential message. "One thought is recognized as indispensable to social welfare, the worker with whom thought is the labor contribution will receive the same economic recognition as is accorded to those who produce material things; and the appreciation of their work will grow as society itself advances in knowledge and intellectual apprehension." Early chapters of the book attempt to define "the intellectual worker," as one whose occupation is, primarily, neither physical nor manual. "Placed as he is economically between capital and manual labor, he is exposed to encroachments from both . . . The authority of the employer tends to manifest itself in the standardization of performance, the payment of wages or salaries based upon time rather than upon intellectual value. . . . In no real sense is the intellectual worker a capitalist. His so-called 'intellectual capital' . . . is an inherent quality, refined and developed no doubt by education and use, but in its essence a part of the nature of the individual himself. . . . Intellectual work is a commodity; its economical value depends upon the gain that can be drawn from its exploitation. . . . As a laborer and a wage earner, accordingly, the intellectual worker is subject to all the conditions which determine the economic status of labor generally . . . And because the intellectual worker is economically a wage earner and not a capitalist, his wages, like the wages of the manual or clerical worker, will always be determined in the long run by his standard of living. . . . He will receive what, as an intellectual worker of a given class, it costs him to live as a member of that class." The foregoing is a somewhat sketchy outline of the first 2 chapters.

Chapter III discusses the intellectual product. The section dealing with scientific discovery, invention or process, technical or professional method, is especially interesting. In all groups, however, "Intellectual work is always the work of the mind . . . it is always to some extent creative and original. . . . Be the occupation what it may, however, it is chosen primarily because of a predominant intellectual interest in that direction . . ." This aspect of the subject leads naturally to the question of conditions. The occupations of authors, artists, dramatists, teachers, and others are discussed; and Mr. MacDonald infers, rightly, that the research worker "is in a very high

degree exploited." His wages bear no logical relation to the social value of what he produces. The engineering profession, Mr. MacDonald avers, lacks solidarity.

The public viewpoint is distorted; and, although "Intellectual work is exalted and socially indispensable, its rewards, save in exceptional cases, are prevailingly meager, and the conditions that ordinarily surround it are often extremely ill-adapted to efficiency or contentment . . . Although labor and capital both suffer in hard times, it is the intellectual laborer who usually suffers the most." All these disadvantages are due, in large measure, to the fact that the intellectual worker is seldom a good business man. "He is likely to possess indifferent skill in bargaining, and must often take the terms that are offered, either because he does not know how or where to obtain better ones or because financially he cannot afford to wait. . . . Unless the intellectual worker is generally looked upon as the creator of values or utilities with which society cannot dispense, his economic position will continue to be unstable, even if the grossest forms of economic discrimination are ameliorated."

Intellectual workers have as great an economic bond as non-skilled laborers—the wage-earning character of the labor. Intellectual pursuits, invariably, are interdependent. "If intellectual workers are to take the place in present-day industrial society to which they are entitled, they must unite their forces." Professional unions are considered in detail. The mention of a union connotes a strike. "Will intellectual workers, once they are organized, go on strike?" In some instances, yes. But as a general rule, no. The objection to membership in a professional union in most quarters is that it would result in a lowering of dignity, but of this Mr. MacDonald speaks emphatically. "The superstitious dignity which properly attaches to certain intellectual occupations has long since ceased to be anything more than a cloak for discrimination and exploitation, an excuse for systematic under-payment, and a consequent wholesale lowering of living standards."

Typical organizations of intellectual workers are considered. The National Union of Scientific Workers, in successful operation in Great Britain, is a trade union, certificated as such under the Trade Union Acts. In England "it is actually illegal for any body, except a trade union, to try and persuade its members, even by intellectual argument, not to apply for a post that is being offered on undesirable terms." This union has representatives on the Industrial Councils, in the Air Ministry, in the Departments of Scientific and Industrial Research and in the Ministry of Agriculture and Fisheries. "A sub-committee on economic aims has drawn up an approved scale of salaries, prepared a black-list scheme for dealing with firms which advertise scientific posts at inadequate salaries, and drafted a memorandum on the patent rights of salaried persons whose work may be expected to lead to patentable discoveries." All these questions are of moment to tech-

nologists; and in Great Britain the Union of Scientific Workers has been the first to mold public opinion and prevent injustice by corrective action. "The greater need of the moment," concludes the author, speaking in general terms, "is that the various natural groups of intellectual workers shall organize, that professional group organizations shall federate, and that the united strength of the whole intellectual class shall everywhere be brought to the support and enlargement of intellectual work."

The book makes a strong appeal in behalf of those who share in no logical manner in the gains of capital, business or labor, although contributing materially to the financial prosperity of each. In clarity of presentation the book is exceptional, and Mr. MacDonald's comments and critical analysis will be read by a wide and sympathetic audience.

A. W. ALLEN.

Labor Problems in Steel Industry

EMPLOYEES REPRESENTATION IN STEEL WORKS. By Ben M. Seeksman, Department of Industrial Studies, Russell Sage Foundation, New York. 293 pp. Price \$1.50.

Reviewed by P. B. MacDonald

After the death of the frugal Russell Sage, part of his large fortune was devoted to a foundation for the amelioration of the lot of mankind. The department of industrial studies of this foundation has produced several books recording investigations of the relations of workers with their employers. This little book is one of the series.

It explains the employees' representation plan that is used in the steel-mill of the Colorado Fuel & Iron Company at Pueblo, Colorado. This mill, known as the Minnequa Steel Works, produces 2 per cent of the steel output of the country.

The plan went into effect in 1916; it provides for joint conferences between representatives of the employees and of the management officials; these conferences are held every 4 months—this seems rather a long period between conferences. At the conferences, discussions are held as to wages, working hours and conditions, and grievances. The general aim is to assure to the Colorado steel-workers as beneficial conditions as are enjoyed by the employees of the United States Steel Corporation, which has no such co-operative scheme but rules its workers more or less automatically.

The general conclusion of the book is that in some respects the scheme has been a good thing, and in some respects it is inadequate. The competition of the enormous Steel Corporation is the predominant influence in the industry, even as affecting wages and working conditions of competitors.

Whether or not Russell Sage's money is doing more good by making possible such investigations as this than it would do by endowing professional chairs at a university—say a chair of chemistry or of the history of science—is left for the individual readers of the book to decide.

Agitating Stirring and Kneading

AGITATING STIRRING AND KNEADING MACHINERY. By Hartland Seymour, consulting chemical engineer. 139 pages. D. Van Nostrand Co., New York. Price, \$3.

This book is a companion to "Mechanical Mixing Machinery," as it overlaps in the field covered, but the method of presentation is distinctly different. There

is an admixture of description and quantitative operating data that makes the book useful as a reference for the plant engineer. The author has classified problems of mixing into: (1) the mixing of two liquids, (2) the mixing of two solids, (3) the mixing of a solid and a liquid. The first is termed agitating or stirring, the second mixing, and the third kneading.

The descriptive text includes paddle, gate-type, propeller, helical, spiral, turbine, air-lift, and adjustable paddle agitators; double-motion and jacketed stirrers, kneaders, pan mills, emulsifiers, "colloid" mills, agitator drives and paint mills. The quantitative tables give air and power characteristics of Dorr agitators, reduction in Plauson mills, and the capacity of Universal kneading machines. The author has done well a difficult task of classification and description.

Mechanical Mixing Machinery

MECHANICAL MIXING MACHINERY. By Leonard Carpenter. 135 pages. D. Van Nostrand Co., New York. Price, \$3.

Young chemical engineers beginning their careers in practical plant operation will find much in this little book. Admittedly it is elementary and descriptive in character, and yet it fills a gap in present day chemical engineering literature. The first two chapters describe the principles of homogeneous and heterogeneous mixing, involving systems comprising solids, liquids or both. Next comes a description of the general types of mixing machines commonly used in the industries. Continuous and batch mixers for handling solids receive the most emphasis. Of especial interest is a chapter on "colloid" mills such as the Plauson, Premier and Hurrell, with notes on specific applications to the rubber, lubricants, fuel and food products industries. The latter half of the book describes the application of mixing machinery to specific industries such as the manufacture of lime, cement, ceramics, fertilizer, rubber, soap, paint and varnish and fine organic chemicals.

Bureau of Mines Publications

Annual Report of the Director of the Bureau of Mines to the Secretary of the Interior, for the fiscal year ended June 30, 1924.

Protection of Oil and Gas Field Equipment Against Corrosion. By R. Van A. Mills. Bull. No. 233.

Detection of Small Quantities of Petroleum Vapor with the Burrell Methane Indicator. By G. W. Jones and W. P. Yant. Tech. P. No. 352.

Conditions Affecting the Activity of Iron Oxides in Removing Hydrogen Sulphide from City Gas. By W. A. Dunkley and R. D. Leitch. Tech. P. No. 332.

Experiments in the Use of Back Pressures on Oil Wells. By T. E. Swigart and C. R. Bopp. Tech. P. No. 322.

Gas Masks for Gasoline and Petroleum Vapors. By S. H. Katz and J. J. Bloomfield. Tech. P. No. 348.

Coke-Oven Accidents in the United States During the Calendar Year 1923. By William W. Adams. Tech. P. No. 371.

Bureau of Standards Publications

U. S. Government Master Specification for Heavy Rust-preventive Compound. Circ. No. 200.

Use of U. S. Government Specification Paints and Paint Materials. By P. H. Walker and E. F. Hickson. Tech. P. No. 274.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Tunnel Kilns for Making Brick

To the Editor of *Chem. & Met.*:

Sir—Your issue of Nov. 17, 1924, on p. 767, contains the description of a "new" tunnel kiln for burning brick and earthenware at the Vitrefax Company, Vernon plant, Los Angeles, Calif. This article was entitled "Lesson in Modern Manufacture" and one of the photographs reproduced had the notation: "An Eye Opener for the Old Time Brick Maker."

It is my belief that the minds of "the Old Time Brick Makers" mentioned would immediately harp back to 1900-02, when A. A. Gery of Reading, Pa., invented and patented each step in this process, including the original car for burning brick, identical with that shown on p. 766 of your November, 1924, issue, and then finally secured a basic patent on the whole process. All of this despite the claims of the Los Angeles company, the claims of an East Liverpool, Ohio, company and the claims of a Lincoln, Calif., company for originality in the design of tunnel kilns which they have installed in the past 3 years.

The process is not new. It is just the slowness of the earthenware manufacturers to adopt new methods and their unwillingness to pay the inventor for his efforts, that has caused them to hold back until the Gery patents had expired. The original plant was built by A. A. Gery for the Montello Brick Works at their Oaks factory, Perkiomen, Pa., and was put in operation in 1904-05. Briefly the plant consisted of 48 tunnels, in two units of 24 tunnels each. In each unit 12 tunnels were superimposed above 12 other tunnels; the blocks of tunnels were solid, to conserve the heat. This idea, as well as that of placing them above each other, was a mistake that led to unequal contraction and expansion of the tunnels in the fire zone and caused us some trouble after the tunnels had been under six months or a year of constant fire. One thousand brick were set on each car, the cars being bolted together and pushed into the tunnels, first by a chain drive and later by air-operated rams or "pushers." The brick on the cars were dried and water-smoked in the tunnels by the waste heat from the burning zone, were burned in this zone by 6 oil burners and a little coal added between the burner holes, both injected from the top of the kiln, and were cooled in the tunnel, after burning, by the air drawn into the tunnel for the combustion of the fires.

The heat was judged, through peep holes in the top of the kilns, by the old "eye method" and by the color of the fires as seen through the cooling end of the tunnels. This was a weakness of the process, because it introduced a personal element into what should have been automatic. The output of this plant was 250,000 brick per day. When the tunnels were new, the "pushes" regular, the burning perfect, 1 car of 1,000 brick per tunnel, or 48,000 brick for the 48 tunnels, were burned every 4 hours. In this case, 90 per cent of the brick on each car would be No. 1 and 10 per cent would be salmon, with no waste or imperfect brick.

The method, while patented, was kept secret and only those who worked there or those who were considering the purchase of the process were every permitted to see it. Some prospective purchasers came from as far as Tacoma, Portland and San Francisco to see it.

In 1906, when some difficulty was experienced in the burning and in the mechanical operation of these kilns I was transferred to the plant to find the difficulty and advise in regard to a remedy. It was at this time, while burning 1,000,000 brick now incorporated in the John Wanamaker building in Philadelphia, that we discovered certain defects and that we recommended the installation of equipment for measuring flue gases, the scientific regulation of the amount of air consumed, registering pyrometers, a slight alteration in the tunnels and in the pedestals supporting the running gear of the cars. The latter had been improperly designed and often caused the car wheels to become locked when passing through the fire zone, thus making the train of cars difficult to push. These recommendations, if they had been adopted, would have made the entire process automatic and independent of the personal factor. Unfortunately, the Montello Company had expanded too rapidly and was financially wrecked in 1907, before these changes could be instituted, and the process died with the company.

It was the opinion of "old brick makers" of 1905-07, familiar with the Gery tunnel system of burning brick, that it was an ideal method and could not be surpassed either in results of the "burn" or in economy of operation. It is this system, or some modification of it, with the addition of the automatic devices recommended in 1907, that is suddenly springing into such universal favor for the burning of earthenware. It is the method of the future and I hope that these notes of its inception and of its birth pains may prove interesting.

SAM HUGH BROCKUNIER.

Pittsburgh, Pa.

Danger in Nitrocellulose Residues

To the Editor of *Chem. & Met.*:

Sir—On p. 546 of your April 7, 1924, issue there appeared an article by G. R. Ensminger, entitled "An 'Empty' Tank Explodes." The following are a few suggestions that were developed from a safety standpoint and that may prove valuable to the chemical and designing engineer. If followed, these suggestions will reduce greatly the hazard in connection with handling old equipment of this type.

The design of the alcohol line to the press as shown in Fig. 2 of the original article is poor, and the suggestions made herewith have worked well in similar applications. In fact, I should consider the original design as being dangerous for every-day operation of the equipment.

In the improved design, there is installed in the pipe line to the dehydrating press, a sight flow, a drain connection to a separator, a swing-check valve and 2 high-pressure valves. These are installed in place of the 1 high-pressure valve shown in Fig. 2 of the orig-

inal article. Any number of installations may be connected to the same separator, which should be placed outside the operating room and preferably isolated.

The separator should be of the plain settling tank type. With this type of separator it is possible to recover all products from the leakage. Fortunately, the specific gravities of the substances in the leakage are such as to lend themselves readily to this design of separator. The water outlet pipe of the separator runs to within a few inches of the bottom of the tank; the drain inlet from the press alcohol lines is placed about half-way up and is provided with a water inlet for flushing the tank prior to cleaning; the alcohol outlet is of course near the top; and a clean-out door for the nitrocellulose is placed near the bottom.

This separator was used successfully with substances of high flash point, and it safeguarded our tanks in every way. We salvaged all leakage, and we had no trouble with old tanks. In fact we considered our equipment safer in every way, as all leakage drains centered in one separator, making it easy to inspect this one piece of equipment at cleaning times and when replacement occurs.

HARRY ENSMINGER.

Manufacture of Refined Cane Sugar

To the Editor of *Chem. & Met.*:

Sir—I would appreciate it if you would insert an item in the next issue of your journal explaining that the material referred to in Mr. Allen's article in your March issue as "kieselguhr" or "diatomite" was "Filter-Cel," manufactured by the Celite Products Co.

R. J. WIG.

Los Angeles, Calif.

Recent Articles in Technical Periodical Literature

By P. K. Frölich

Massachusetts Institute of Technology, Cambridge, Mass.

Hydrosulphite Industry. Methods of manufacturing hydrosulphite-formaldehyde compounds. E. Geay, *Rev. Chem. Ind.*, 1925, vol. 34, pp. 85-9.

Barium Sulphide. Industrial methods of making barium sulphide. R. Hazard, *Rev. Chem. Ind.*, 1925, vol. 34, pp. 78-82.

Lignite. Desulphurization and hydration of tar-oils from coking of lignite. A. Fürth and M. Jaenicke, *Z. angew. Chem.*, 1925, vol. 38, pp. 166-73.

Lignite Coking. Chemistry and technology of the process. A. Faber, *Z. angew. Chem.*, 1925, vol. 38, pp. 173-9.

Dyestuffs. New dyes marketed by German manufacturers during 1924. P. Krais, *Z. angew. Chem.*, 1925, vol. 38, pp. 201-3.

Fertilizers. The value of carbon dioxide as a fertilizer. H. Niklas, K. Scharrer and A. Strobel, *Z. angew. Chem.*, 1925, vol. 38, pp. 251-8.

Petroleum. A statistical review of the oil industry. C. A. Fischer, *Nat. Pet. News*, 1925, vol. 17, pp. 41-3.

Crushing and Grinding. Discussion of methods and equipment. S. G. Ure, *Chem. and Ind.*, 1925, vol. 44, pp. 321-7, 349-53.

Malic Acid. Recovery of calcium malate from Canadian and North American maple sugar sand. Present yearly waste is 20 to 30 tons of malic acid. J. F. Snell, *Chem. and Ind.*, 1925, vol. 44, pp. 140-1T.

Corrosion. Water-line corrosion of iron and steel with special reference to the action of inhibitors. U. R. Evans, *Chem. and Ind.*, 1925, vol. 44, pp. 163-9T.

Rubber Pavement. Different methods of applying rubber in the construction of road pavements, and description of results in France. Anon, *India Rubber World*, 1925, vol. 72, pp. 395-7.

Pulverized Fuels. The application of pulverized fuels to boiler firing. W. J. Cotterell, *Combustion*, 1925, vol. 12, pp. 275-8.

Economizers. Calculations of heat transfer in economizers. E. S. Sutton, *Combustion*, 1925, vol. 12, pp. 285-6.

Zinc Oxide Industry. A statistical review of production, consumption, exports and imports of zinc oxide. Anon, *Die Chemische Ind.*, 1925, vol. 48, pp. 146-7.

Hardening of Fat. A review of industrial methods and mechanical equipment in the hardening of fat. W. Normann, *Chemische Apparatus*, 1925, vol. 12, pp. 34-6, 42-5, 54-5.

Motor Fuel. The fuel crisis and proposed remedies. Distillation, cracking with and without catalysts and hydrogenation with nascent hydrogen. Industrial methods and applications. A. Travers, *Chim. and Ind.*, 1925, vol. 13, 85-94T.

Flue Gas. A detailed description and discussion of apparatus used in the testing of flue gases. L. Croon, *Apparatban*, 1925, vol. 37, pp. 57-9, 69-71, 81-3.

Wool Grease. A discussion of an improved method of extracting wool grease. W. Paulsen, *Apparatban*, 1925, vol. 37, pp. 65-6.

Regeneration of Lime. Recovery of lime from sugar solutions. P. Horing, *Chem. Weekblad*, 1925, vol. 22, pp. 165-7.

Synthetic Rubber. Manufacture of synthetic rubber and higher alcohols. Discussion of reaction and methods. A. Dubosc, *Caoutchouc and Gutta-Percha*, 1925, vol. 22, pp. 12,629-30.

Stoker-Fired Boilers. Some common mistakes in operation. J. F. Barkley, *Combustion*, 1925, vol. 12, pp. 345-7.

Scale and Efficiency. Influence of scale on the efficiency and safety of heat appliances; practical tests and calculations. Abstract by A. S. Woodle, Jr., *Combustion*, 1925, vol. 12, pp. 347-53.

Synthetic Methanol. Industrial production of synthetic methanol. C. Lormand, *Ind. Eng. Chem.*, 1925, vol. 17, pp. 430-2.

Boiler Water Treatment. Apparatus for control of boiler water based on chemical equilibrium. R. E. Hall, H. A. Otto and H. A. Jackson, *Ind. Eng. Chem.*, 1925, vol. 17, pp. 409-11.

Substitute for Cocaine Claimed

A report is current in Berlin that Prof. Richard Willstaetter of Munich has successfully developed a substitute for cocaine, known in the German market as "Psicain."

It is claimed that the new synthetic compound is not as dangerous as a habit-forming drug, as is cocaine, as it is not so poisonous. Production cost is likely not to be as much as for cocaine, as the latter must be prepared from the cocoa leaf, imported at considerable expense, from South America. Cocaine sells for about \$100 per pound.

Synthetic psicain can be considered as an advance on novocain and procaine (made by the Hoechster Farbwerke, C. F. Boehringer, and Merck, respectively.) The latter were older attempts to produce, by synthesis, products with the same narcotic effectiveness as cocaine, but they fell short of this aim than the newly reported psicain is said to have done.

The Plant Notebook

An Exchange for Operating Men

Notes On Welding and Cutting By Carbon Arc

By William L. Warner

General Electric Co., Schenectady, N. Y.

In carbon arc welding the electrode consists of a carbon or graphite pencil or rod, the additional metal required by the weld being supplied by a metal rod that is melted in the arc and flows into the pool of metal melted from the parts to be welded. For cutting or melting away excess stock, the carbon or graphite electrode is used alone. The arc is held stationary at a point on the work where fused metal is free to flow and, as the metal melts and runs off, the arc is advanced. In this way a cut is made, or rather melted, through the work.

Welds soft enough to be machined can be made by either the carbon arc method or the metallic method if reasonable care is taken. If a carbon or graphite electrode is used, the arc should be long enough to prevent carbon being absorbed by the weld. Other causes of hard welds are sudden chilling, poor quality of electrode or filling metal, and contamination of the weld by foreign matter.

When a carbon electrode is used for welding the arc should be from $\frac{1}{4}$ to $1\frac{1}{2}$ in. long, and should give a slight hissing sound. For cutting, the arc should be shortened to about half this length, in order to concentrate heat at the point on the plate where the cut is to be made. The arc will then apparently become unstable and give off a hissing, squealing and snorting sound. The length of the arc depends on the amount of current used, being generally shorter with low current.

Electrodes should be rods of hard, homogeneous, uncored and uncoated carbon or graphite, not necessarily chemically pure, but without much foreign matter. The carbon electrode is somewhat stronger than the graphite and will therefore stand handling better. As graphite has a lower resistance than carbon, it will carry more current for the same heating, or it can be used at the same current with a slower rate of burning away than the carbon electrode.

The soundness of a weld made with a carbon arc depends on having a molten spot on the work into which the molten filler metal runs and is thoroughly mixed by the agitation caused by the arc. The metal used as filler depends on the work to be done and the metal to be welded. For steel plates or casings, the quality of the metal is ordinarily the same as used for welding with metallic electrodes, although for carbon arc welding it is generally used in rods of $\frac{1}{4}$ to $\frac{3}{4}$ in. diameter. In filling large openings it is often possible to use metal chips,



Type of Set-up Used for Making Carbon Arc Weld on a Casting

steel turnings, or small pieces of steel. But care should be taken to see that the added metal is thoroughly fused with the metal of the piece and not merely plastered over with a shell of apparently sound metal.

In welding cast iron, the filler metal may be either cast iron rods specially made and usually containing considerable silicon, or small pieces of ordinary cast iron. Sometimes a borax or sodium compound is used as a flux to "float out" the slag and oxide in order to prevent inclusions in the deposited metal.

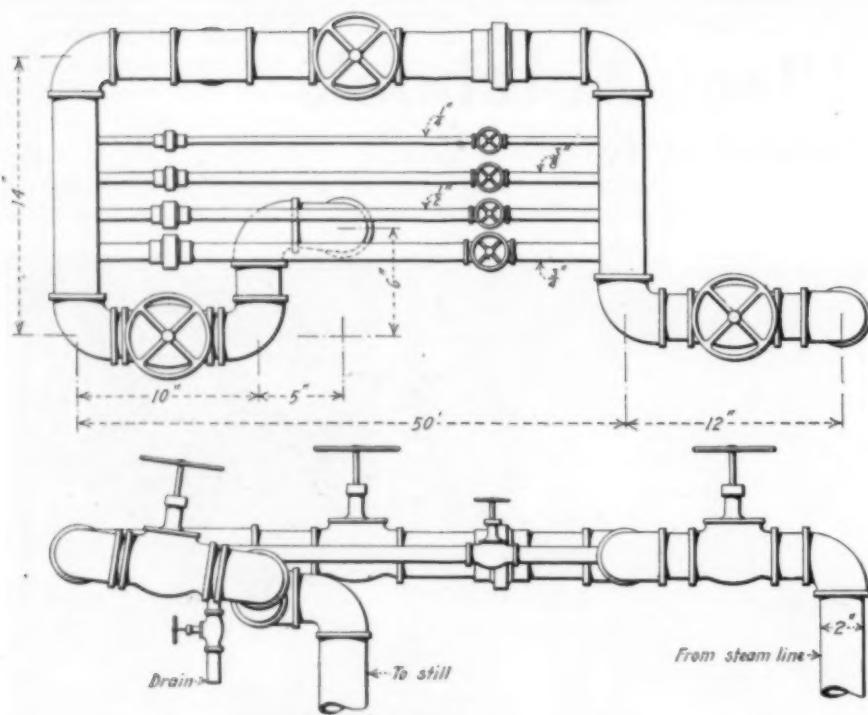
necessarily loud enough to be disagreeable, it is found to work well in reducing unnecessary losses.

Using Electric Heat to Speed Production

The makers of electric heating appliances put out many small, standard devices such as space heaters, liquid heaters and small heated pots or kettles that can be applied in various operation in such a manner as to speed up production and increase plant efficiency. As an example, one plant finds it necessary to wrap all of their finished products in heavy paper wrappings of the spiral type before shipping. This spiral wrapping is put on by a machine and when one package is completely wrapped, it is necessary for the operator to cut the wrapping strip, take the package from the machine and paste down the free end of the paper. It was found that, by using an electric heater in the paste pot, of sufficient size to keep the paste always at the best possible consistency, an appreciable amount of saving was made in the time necessary for wrapping the packages and the production of the plant was thus speeded up.

How Gongs Can Help Save Heat

Self-closing doors for drier rooms or for refrigerated compartments are not always practical. But the doors of such inclosures must be kept closed as much as possible in order to conserve the store of "cold" or heat. A very simple expedient that is used in some plants to cut down these "open-door" losses consists in installing an electric gong with a circuit such that when the door is opened the gong starts to ring and continues to do so until the door is again shut. Although the resulting noise is



Regulating Bypass for Steam Lines Feeding Steam-heated Apparatus

Simple Device for Regulating Steam Supply

A system for controlling the amount of steam fed to stills and other steam heated apparatus has been worked out by O. C. Smith, assistant superintendent, Skelly Oil Co., El Dorado, Kan., and was recently described in the National Petroleum News.

This system, shown in the accompanying sketch, consists in placing a bypass in the steam line just before it enters the apparatus, made up of several small pipes, each fitted with valves. A valve in the main steam line just ahead of the bypass is left open, but a valve just beyond the bypass entrance is kept closed. Then by opening or closing the valves in the small pipes making up the by-pass, the amount of steam can be varied to suit the requirements with fair accuracy.

Method for Removing Articles From Belt Conveyors

Difficulty is often experienced in removing packages, containers or material of similar form and shape from flat belt conveyors used for moving it, say, from a manufacturing department to a storeroom or shipping department. A method adopted by one company for accomplishing this is so successful that it should prove helpful to others.

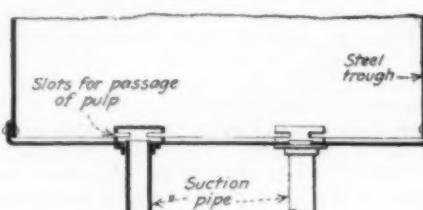
At the point of the conveyor at which it is desired to remove the packages, a snubber is placed consisting of a short length of roller conveyor bent into the arc of a circle (that is, bent along its longitudinal axis) and having a radius of about 6 feet. This roller section is supported from a framework independently of the conveyor and is so located that the motion of the conveyor causes the packages to strike against the rollers, the axes of which

are vertical. As the belt tends to force these packages against the rollers, they are easily and steadily forced off the belt in the direction of the curve of the section of rollers. As they leave the belt they are deposited either on a chute or a gravity roller conveyor which conveys them to the desired point of delivery.

This whole snubber arrangement can be made portable and by placing it in one location or another, the packages can be removed from the belt at any desired point.

Home-made Guard for Pump Suction

Tramp iron—nails, washers and pieces of broken metal of all descriptions—causes trouble when a pump suction is connected direct to the bottom of a trough or tank acting as a receiver for pulp. At the plant of the Mason Byproducts Co., Sausalito, Calif., where alcohol is made from raisins, the pulped raw material is pumped from a trough placed underneath the disintegrating mills. To prevent the trouble mentioned above, a cap, with slots as shown in the accompanying illustration, is placed over each suction opening and welding in place. This is made of welded plate. The suction supply is therefore drawn from an inch or so above the level of the bottom of the trough. Pieces of metal lodge on the bottom, and are removed by hand.

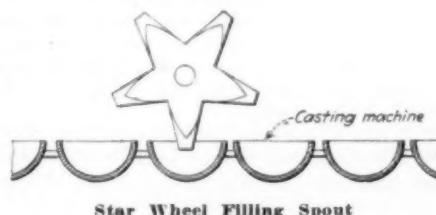


Slotted Cap as Pump Suction Guard

Star Wheel for Filling Molds In Continuous Operations

In some processes it is necessary to fill an endless series of containers with a molten or otherwise liquid material, as when a wax is to be cast in molds on a casting machine. In such operations trouble is often experienced in preventing losses as the molds or containers pass the filling station, caused by material spilling through the opening between each pair of molds.

The use of a simple filling device that can be easily made in any shop, will do away with this spilling. The device is a filling head in the form of a star wheel, as shown in the accompanying sketch. This wheel has a series of five spouts arranged in the form of a star. It is attached to the end of the filling spout or pipe in a manner that permits easy revolution. The point of the wheel which is lowest at any time projects sufficiently into the mold or container so that the lateral motion of this container on the casting machine pushes each point of the star up and out of the way, the next point entering the next container and directing the flow of liquid into it. By a proper adjustment between the rate of flow and the speed of the casting machine, a condition is obtained by which each container is just filled during the time it is being fed from one of these spouts of the star wheel.



Method for Lining Tanks With Bitumen

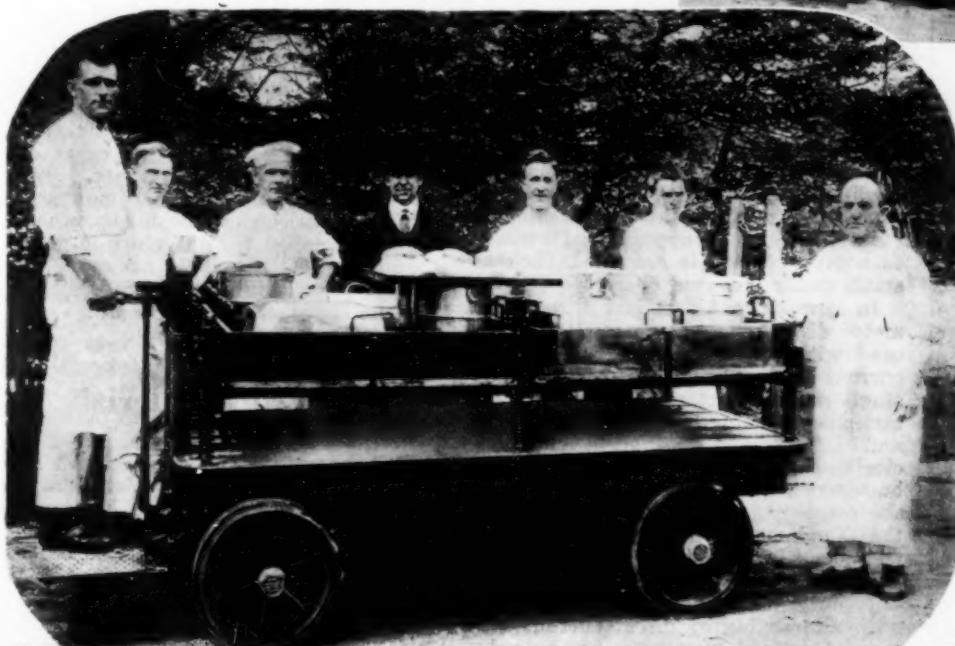
The practice of coating acid tanks with bituminous mixtures to promote resistance to corrosive action has been general for some time. The best method of application and best compound for a given kind of service will obviously vary. Still the experience of one concern that has had success in handling problems of this sort is instructive.

Gilsonite, asphalt, cumarin resin and ordinary rosin are used, including usually 20 to 50 per cent of the resinous constituent. These are melted together in a metal tub, then applied with a broom to the cleaned inner tank surface leaving a rough coating about $\frac{1}{8}$ in. thick. The seams are usually filled with a special coat of the same or similar material previous to the overall treatment.

To an iron pipe, light enough to be readily handled, a flexible connection is made to a gas main. A man working inside the tank, beginning at the top slowly moves this improvised torch around flowing the coat on smoothly and evenly. The finished job is said to be decidedly superior to that which can be obtained by means of a swabbing operation only.

Industrial Trucks

*The General Utility Worker
in
The Handling Field*



TOP—Standard uses of industrial trucks, as in this dye plant, are alone sufficient to make this type of handling equipment one of the most valuable that can be employed.

MIDDLE—An unusual, but highly profitable, use for a truck. The special body permits hot and cold food to be taken directly to the workers, saving much time and energy.

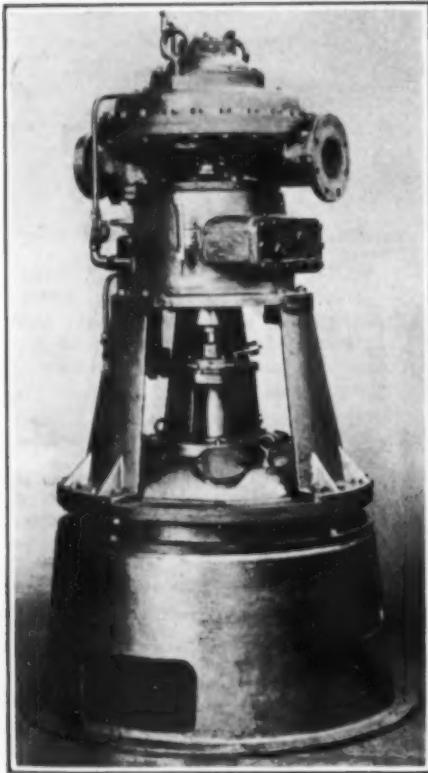
BELOW—Special bodies, like this, are available in infinite variety. They can be made removable and interchangeable, permitting fullest use of each truck.



Equipment News

From Maker and User

Turbine Drive For Colloid Mill



The above picture shows the direct connected steam turbine drive recently developed by the Westinghouse Electric & Manufacturing Co. of East Pittsburgh, Pa., for the Premier Mill Corporation of Geneva, N. Y. This mill, which is of the colloid type, is shown mounted with vertical shaft on a base plate with the turbine mounted directly above. Prior to this development, these mills have been either belt or electric motor driven. Now all three types are available, depending on service requirements.

Electrical Instruments Redesigned

The horizontal edgewise switchboard indicating instruments, manufactured by the General Electric Company and known as its H-2 type, have been redesigned and the new line, to be designated as type H-5, will soon be on the market. The line includes ammeters, voltmeters, wattmeters, power factor meters and frequency meters, for use wherever the measurement of electrical energy is necessary.

Among the changes made in this line are improved armature coil and pointer construction, increased insulation of

current winding; non-corrosive finish on frame, magnets, screws, etc., and new strip-wound magnetic shield. The jewels and pivots in these instruments have been reversed, the jewels being mounted on the armature shaft while the pivots are mounted in the frame, thus permitting their ready removal. Resistors for the new wattmeters and voltmeters have been mounted inside the instruments, for the purpose of simplifying switchboard wiring and of saving space.

Hoist Starter

A new General Electric reversing starter, bearing the designation CR-7009-M4, has been designed particularly for monorail hoist service and has accordingly been made very small and compact. Its use is also advocated on numerous other applications where economy of space is essential, such as small motor operated doors.

In operation, this starter throws the motor directly on the line. It may be used with either alternating or direct current motors, and consists of four single-pole contactors mechanically interlocked, mounted on a suitable base and enclosed in a small sheet metal enclosing case for wall mounting. A push-button station is provided for operating the contactors, which are so arranged that the motor will run only so long as the push button remains depressed.

For monorail hoist or other intermittent duty, this starter may be used, with alternating or direct current motors of ratings up to five hp. on voltages from 115 to 550.

The overall dimensions of the enclosed device are: Width, 14 inches; height, 9 inches; depth, 6 inches. It is well constructed and so arranged that the cover may be locked shut if desired. Knockouts are provided for 1-inch conduit.

Concentration in Solutions

An instrument called the nephelometer, by means of which the concentration of solid matter in turbid solutions can be determined, has been brought out by the American Kreuger & Toll Corp., 522 Fifth Ave., New York. In this instrument, 2 Tyndall cones, of variable height, are produced in 2 glass cylinders. Reflected light is used, the intensity of which is compared perpendicularly, by means of a lens. Variation in the intensity of light is secured by changing the depth of the Tyndall cones. When uniform illumination is obtained, the concentration of the test is determined according to the height of opening on a scale, as compared to that of a solution of some standard turbidity. The maximum error, under proper control, is under 0.5 per cent.

Stress Strains in Rubber

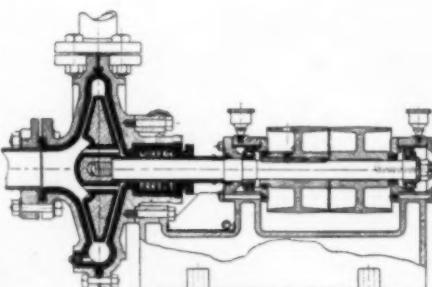
A new device for recording the stress strains in rubber is being put out by the Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York. This instrument is the invention of C. S. Williams, head of that company's rubber service department. Its action is based on the movement of 2 pointers which follow marks made 1 in. apart on the rubber sample. As the sample is stretched these marks are separated, the recording chart is raised an equal distance and at the same time a pen is carried across the chart at right angles to an amount proportional to the tension applied.

With this device, one operator may plot directly the stress strain curve of a sample. Where samples are being compared that are of the same gage, direct comparison can be made, otherwise a correction for difference in gage is applied. With a little practice, the operator can attain sufficient skill so that the curve drawn is smooth.

Acid Proof Material

Olivite, used for acid proofing a new type of centrifugal pump developed by the Oliver-Sherwood Co., San Francisco, Calif., is a substance having a rubber base, but said to possess a combination of qualities found in no other material. It is claimed that it has all the chemical resistant qualities of hard rubber, but none of its physical defects. It is not brittle, it has a high tensile strength, is resistant to wear, and is ideally adapted for the handling of corrosive solutions, even at high temperatures.

The Olivite lining of the pump shown in the accompanying drawing is practically unbreakable and is an integral part of the cast-iron shell or casing.



Cross-Sectional Drawing of a Centrifugal Pump Lined with Olivite

By the use of a patented floating or resilient stuffing box it is believed that packing trouble and cutting of the shaft can be avoided. The pump has Timken bearings, and is rated to compare favorably with any centrifugal

pump on the market in regard to mechanical efficiency. It is said to be well suited for the handling of food products. For this purpose it is made in an entirely white construction, inside and out, thereby facilitating efficient cleansing.

The durability of Olivite linings is demonstrated by a digester now in use which is being subjected to temperatures of 250 deg. F. under high pressure, then rapidly emptied and chilled with cold water to 50 deg. The lining under this treatment shows no signs of cracking or breaking away from the steel backing. Olivite vessels or mechanical parts can be supplied molded in almost any form, to meet special requirements. Bearings of "cutless" grade Olivite may be submerged in chemical pulps without being cut and without cutting the shafting.

Motor Starters

Among the recent developments in industrial control are three new types of starter now being marketed by the General Electric Company. These are an enclosed magnetic switch for starting two-and three-phase alternating-current motors, and two types of automatic starter for synchronous motors, one for full-voltage starting and the other for reduced-voltage starting.

The enclosed magnetic switch bears the designation CR-7006-D9 and is for use with two- and three-phase alternating-current motors which can be thrown directly on the line in starting. This switch is also used to handle the primary circuit of a slip ring motor in conjunction with a secondary drum switch. The CR-7006-D9 was developed for starting larger motors than can

be handled by the CR-7005 and CR-7006 types of switch now on the market. Overload protection is provided by means of a relay which follows very closely the heating curves of the motor. This switch can be operated by a push button, pressure governor, float switch or similar device and, when used as a primary switch for slip ring motors, a drum switch is the only accessory needed.

The new synchronous motor starters bear the numbers CR-7065 and CR-7061, for full and reduced voltage starting, respectively. Both starters are completely automatic and provide an easy and dependable means of starting synchronous motors. Special features are a temperature overload relay for close protection of the motor from overload, a definite time relay which determines the accelerating period during which the motor is connected to the compensator taps and a field controlling relay for closing the field contactor.

The CR-7065 starter is recommended for use with slow-speed synchronous motors driving pumps, compressors, and for other general applications. The CR-7061 starter is recommended for use with medium and high-speed synchronous motors for driving pumps, motor generators, etc.

Acid Resistant Alloy

A new non-ferrous alloy, called "Alcumite," for use in the construction of equipment has been placed on the market by the Duriron Co., Inc., Dayton, Ohio. This alloy is said to be resistant to sulphuric acid under 60 deg. Bé., sulphurous acid, phosphoric acid, weak solutions of hydrochloric acid and a

large number of sulphates and chlorides, fatty acids and fruit juices.

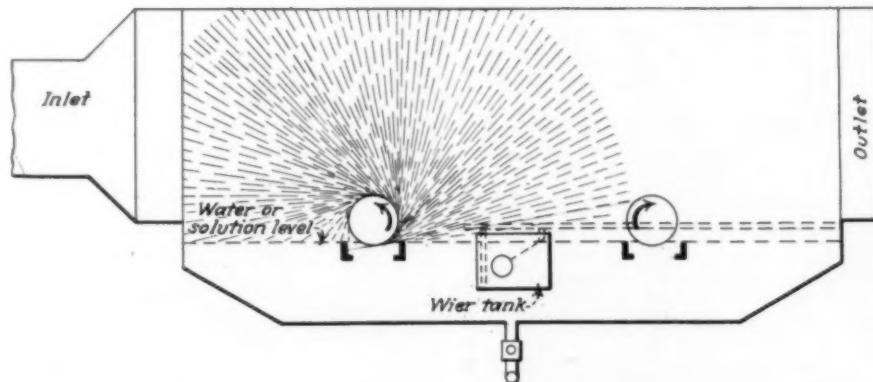
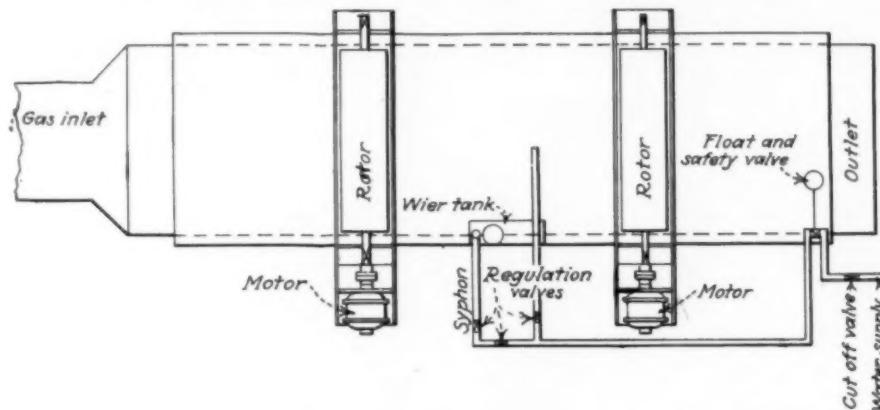
The melting point of this alloy is approximately 1,900 deg. F., and up to 1,600 deg. it remains tough, strong and ductile. The ultimate tensile strength of the rolled material is about 100,000 lb. per sq.in., the ductility depending on the heat treatment applied. Castings have a tensile strength of approximately 75,000 lb. per sq.in. with about 25 per cent elongation. The metal is said to machine readily. It can be sheared and punched, and annealed sheets can be formed and worked cold. Sheets can be furnished in several degrees of hardness.

Liquid Spray Machine

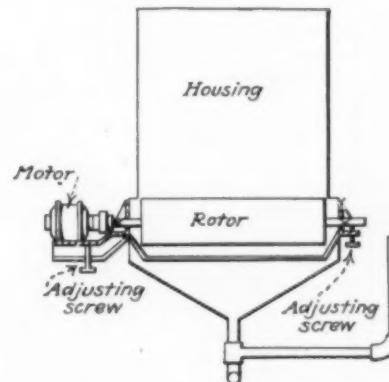
A novel type of apparatus for the spraying of liquids is made by the Hardinge Co., York, Pa. It is known as the Christensen tangential spray machine. In its operation, smooth surfaced rotors, running at high speed, throw off a continuous shower of small particles of liquid forming an effective screen. The lower part of the rotor dips in a bath of the liquid to be sprayed.

The essential features of the apparatus may be duplicated as required. A double rotor unit is shown in the accompanying drawing. Referring to this drawing, the operation is as follows: The gas or air loaded with fine particles that it is desired to remove, passes into the chamber over the rotors. The bottom of this chamber forms the bath into which the rotors dip. Liquid level in this bath is maintained at a constant, predetermined point by a regulating valve and a check float valve.

The rotors are each connected directly to a $\frac{1}{2}$ hp. motor running at 875 r.p.m. The level of these rotors can be adjusted by screws. If the dust is soluble, a continuous overflow of concentrated liquor may be obtained by arranging a gooseneck to discharge on a level with the bath in the chamber. Intermittent discharge is possible by maintaining the gooseneck pipe in an upright position except when it is desired to withdraw liquor. A modified form of the apparatus has been used successfully for the recovery of non-soluble dusts from air from grinding, calcining or drying machines.



The Christensen Tangential Spray Machine



Small Size Motors

A line of small size motors lubricated by a new system has been brought out by the Century Electric Co., St. Louis, Mo. In this lubrication system a number of continuous strands of pure wool yarn are introduced into the bearing housing and oil well, to replace the present methods of carrying oil to the shaft surface. Contact of this yarn with the shaft is assured by a spring attached to the under side of the oil well cover which serves to push the wool down.



Section Showing Motor Bearing With Wool Yarn System of Lubrication

This pure wool yarn is of high absorption power and holds a large volume of the lubricant. It is claimed that the yarn alone will hold sufficient oil to lubricate a small motor for one year at 24-hour continuous operation.

Rigid Hammer Crusher

A crusher designed especially for reducing run-of-mine coal to a uniform product consisting of smaller-sized pieces with a less amount of fines than given by other crushers, has been designed by the Jeffrey Mfg. Co., Columbus, Ohio. This machine, called the "Rigid Hammer" crusher, is of heavy construction with renewable wearing parts. The rotor is made up of steel disks mounted on a shaft, to which the crushing teeth are attached by steel through bolts. These teeth are of manganese steel and have six wearing corners each, that are brought into play as needed by turning the tooth. There is a drop bottom screen frame operated by weighted levers for the release of overloads, removal of tramp iron, etc. The heavy flywheel is connected to the shaft by a breaking pin.

This crusher is said to produce a small, uniformly-sized product in one operation—smaller than before produced without screening, and yet with little fines. In a test under actual plant operating conditions a 42x36 machine consumed only $\frac{1}{2}$ hp. per ton per hour when crushing at the rate of 100 tons per hour. The product from the same test showed:

99 per cent through $\frac{1}{4}$ -in. mesh screen
86 per cent through $\frac{1}{8}$ -in. mesh screen
67 per cent through $\frac{1}{16}$ -in. mesh screen
44 per cent through $\frac{1}{32}$ -in. mesh screen
30 per cent through $\frac{1}{64}$ -in. mesh screen
21 per cent through 10-mesh screen
11 per cent through 20-mesh screen

With an assortment of machine sizes and by adjustments within each size, a complete range of capacities and products from a few tons to hundreds of tons per hour is available. The adjustments are made in the breaker plate or screen bar spacing, also by regulating the speed of the crusher rotor. The same adjustments make it possible to produce large or small pieces with any one of the machine sizes. In the test mentioned above the screen bars were spaced $\frac{1}{4}$ in. apart and the rotor was running 220 revolutions per minute.

Friction Clutch

A new model of the well-known Lemley clutch, Model F, has been placed on the market recently by the W. A. Jones Foundry & Machine Co., 4401 W. Roosevelt Road, Chicago, Ill. This is a medium and light duty clutch of the friction type for all purposes. It is furnished as sleeve clutches, cut-off couplings, or bolted to the arms of pulleys, sprockets, gears or sheaves.

Manufacturers' Latest Publications

Clement K. Quinn & Co., Duluth, Minn.—A catalog of Lake Superior iron ores entitled "1925 Analyses."

W. A. Jones Foundry & Machine Co., 4401 W. Roosevelt Road, Chicago, Ill.—General Catalog No. 30—A new general catalog covering all types of power transmitting machinery as made by this concern.

Hardinge Co., York, Pa.—Bulletin No. 19—A bulletin describing grinding and mixing with batch mills of the cylindrical batch mill and Hardinge conical batch mill types.

Hardinge Co., York, Pa.—Bulletin No. 18—A bulletin describing fine grinding with tube mills of the conical type.

Universal Vibrating Screen Co., Racine, Wis.—Catalog No. 50—A catalog of the "Universal" mechanical vibrating screen, an inclined gyratory screen fully equipped with self-aligning ball-bearings for sifting all classes of materials.

C. L. Best Tractor Co., San Leandro, Calif.—Two new folders describing the use of gasoline tractors for road building and general purposes.

General Electric Co., Schenectady, N. Y.—A booklet describing the characteristics and application of General Electric metallic welding electrodes.

Bridgeport Brass Co., Bridgeport, Conn.—Data Book No. 16—A book giving the weights and prices of sheet brass, brass rod, wire, condenser tubes, and seamless brass and copper tubes.

Duriron Co., Dayton, O.—Bulletin No. 138—A new bulletin describing valves, cocks and ejectors of duriron.

Duriron Co., Dayton, O.—Bulletin No. 137—A folder describing standard pipe and fittings of duriron.

Wheeler Condenser & Engineering Co., Carteret, N. J.—Catalog 117—A new catalog giving the theory, construction and application of Wheeler evaporators for chemical plants, sugar refineries, fertilizer and packing plants and for supplying steam boiler make-up water.

Goodman Mfg. Co., Chicago, Ill.—Catalog No. 250—A new catalog of electric locomotives for industrial use, giving specifications of all types and illustrating their applications.

Link-Belt Co., Chicago, Ill.—Book No. 546—A catalog of skip hoists of all capacities, giving complete descriptions of the machines, specifications and descriptions and pictures of applications.

General Electric Co., Schenectady, N. Y.—Bulletin No. 42567—A bulletin describing sine wave generator sets for testing purposes.

American Blower Co., Detroit, Mich.—Bulletin No. 1801—A new general catalog of "Sirocco" fans and blowers for all purposes.

American Blower Co., Detroit, Mich.—Two new leaflets, one on direct fired unit heaters and the other giving specifications of "ABC" air washing and cooling fans.

Uehling Instrument Co., Paterson, N. J.—Bulletin No. 118. A folder describing

the "Apex" line of indicating and recording CO_2 meters.

General Electric Co., Schenectady, N. Y.—Bulletin No. 47640.2—A new catalog of induction, time, over-current relays, describing four types, IA-201, IA-202, IA-205 and IA-206, and their application.

Plibrico Jointless Fire Brick Co., Chicago, Ill.—The 1925 edition of catalog entitled "Refractories and Furnace Design," which is a description of the methods of building monolithic furnace linings with Plibrico.

Chas. Cory & Sons, Inc., 183 Varick St., New York City—Bulletin No. 105-29-B, parts 1 and 2—New bulletins describing the central station load indicator and the Robinson interlock switch.

John Chatillon & Sons, 85 Clinton St., New York City—A pamphlet describing the Abraham Consistometer, a device used for determining the hardness or consistency of bimetallic materials.

Sangamo Electric Co., Springfield, Ill.—A new folder on the subject of electric meter accuracy.

Jeffrey Manufacturing Co., Columbus, Ohio—Catalog No. 410—A catalog describing standardized types of bucket elevators for use in all different types of mechanical handling installations.

Quigley Furnace Specialties Co., 26 Cortlandt St., New York City—A booklet giving directions for using Hytempite, a high temperature bond for various industrial purposes.

Crescent Refractories Co., Curwensville, Pa.—Series I, No. 10—A data sheet giving notes on industrial furnace design.

The U. S. Stoneware Co., Akron, Ohio—Two new bulletins, the first describing etching tubs, vats and similar equipment for photo engraving and allied industries, and the second describing stoneware developing tanks for photographic use, and also a new line of stoneware trays.

Century Electric Co., St. Louis, Mo.—A folder describing a new line of fractional horsepower motors lubricated by means of wool yarn packed bearings.

The New Departure Manufacturing Co., Bristol, Conn.—A folder describing the use of ball bearings for electric motors.

Taber Pump Co., Buffalo, N. Y.—A folder entitled "The Shortest Distance Between Two Points" describing the various types of pumps made by this company.

Cochrane Corporation, Philadelphia, Pa.—Catalog No. 1320—A catalog describing various types of "Creasey" icebreakers, equipment used for breaking up ice for industrial purposes in capacities from 1 to 50 tons per hour.

Riehle Bros. Testing Machine Co., Philadelphia, Pa.—A new catalog describing standard vertical screw power testing machines for various purposes.

C. L. Best Tractor Co., San Leandro, Calif.—A folder giving the results of tests made on tractors by the State of Nebraska.

Steere Engineering Co., Detroit, Mich.—Pamphlet No. 278—A reprint on the use of water in place of steam in the Backrun Gas Process.

The Connersville Blower Co., Connersville, Ind.—Bulletin 19D—A catalogue describing cycloidal rotary pumps for handling oils, molasses, cane juices, greases, chemicals, tar and similar liquids.

Plimpton Lift Truck Corporation, Stamford, Conn.—A bulletin describing the Plimpton four-wheel lift truck and illustrating by diagram and photograph its use in manufacturing plants.

The Poole Engineering & Machine Co., Baltimore, Md.—A bulletin entitled "Do You Know How Poole Gears Are Made?" describing the method by which machine moulded gears are made by this company.

American Spiral Pipe Works, Chicago, Ill.—Catalogue No. 24—A complete catalogue describing all types of forged steel pipe flanges for use with pipe, tanks, boilers and similar equipment, and also giving much engineering information of value to users of this type of equipment.

Merrick Scale Manufacturing Co., Passaic, N. J.—A catalogue describing the Merrick Conveyor Weightometer, for use in weighing materials that are conveyed; showing diagrams of the method of applying this device and various photographs of its industrial use.

Newark Wire Cloth Co., Newark, N. J.—Catalogue No. 25—A new and complete catalogue of wire cloth for use in screens, sieves, filters, dipping baskets and similar equipment, giving the various sizes and materials available and also a list of the uses.

John C. Dolph Co., Newark, N. J.—A folder describing the use of Chinalak Quick Baking Elastic Insulator for electrical coils.

Reynolds Electric Company, Chicago, Ill.—Bulletin No. 701—A bulletin on the Reynolds machine for testing the cohesive ness of sand used for molding and for similar work.

Patents Issued March 31 to April 28, 1925

Paper, Pulp and Sugar

Process of Making Pulp for Paper. George L. Bidwell, Riegelsville, Pa., assignor to The Warren Manufacturing Company, Riegelsville, N. J.—1,531,728.

Process for Making Paper Half-Stock. Bertrand S. Summers, Port Huron, Mich.—1,531,319.

Process of and Apparatus for Making Fiber Boards. John K. Shaw, Minneapolis, Minn., assignor to C. F. Dahlberg, St. Paul, Minn.—1,532,083.

Paper-Making Machine. Anton J. Haug, Nashua, N. H.—1,531,482.

Industrial Utilization of Strawlike Materials. Emeric Markóczl and Stephen J. Adam, Budapest, Hungary, assignors of one-half to Felix R. Wiesner and Hugo Mechwart, both of Budapest, Hungary.—1,534,236.

Palatable Beet Sirup and Process of Preparing the Same. Henry W. Dahlberg, Denver, Colo., assignor to The Great Western Sugar Company, Denver, Colo.—1,534,166.

Purifying and Filtering Process. Johan Nicolaas Adolf Sauer, Amsterdam, Netherlands, assignor to Naamloze Vennootschap Norit Witsulker Maatschappij (also called Norit White Sugar Company), Amsterdam, Netherlands.—1,533,030.

Rubber and Synthetic Plastics

Superficially-finished Rubber Article or Material and Method of Producing Same. Charles H. Dennison, Quincy, Mass., assignor to American Rubber Company, East Cambridge, Mass.—1,532,234.

Manufacture of Rubber Goods. Bruce Keith Brown, Terre Haute, Ind., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,532,651.

Rubber Composition and Method of Preserving Rubber. William C. Geer and Webster N. Jones, Akron, Ohio, assignors to B. F. Goodrich Company, New York, N. Y.—1,532,398.

Rubber Flooring and Process of Making the Same. James H. Stedman, Braintree, Mass.—1,531,763.

Method of Vulcanizing Rubber. Clayton W. Bedford, Akron, Ohio, assignor to The Goodyear Tire & Rubber Company, Akron, Ohio.—1,532,645.

Composite Rubber and Leather Material and Method of Making the Same. Allen G. McKinnon, Andover, Mass., assignor to Boston Rubber Shoe Company, Malden Mass.—1,534,456.

Renewed Rubber and Process for Producing the Same. Herbert A. Winkelmann, Akron, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y.—1,532,213.

Process for Vulcanizing Rubber and Product Obtained Thereby. Sidney M. Caldwell, Leonia, N. J., assignor to The Naugatuck Chemical Company.—1,532,225.

Composition of Matter for Tire Fillers. William L. von Edelkrantz, San Francisco, Calif.—1,535,361.

Lacquer and Lacquer Enamel. Stanley D. Shipley and Guy C. Given, Stamford, Conn., assignors to Atlas Powder Company, Wilmington, Del.—1,533,616.

Cellulose Ester of Reduced Viscosity and Process of Making Same. Earle C. Pitman, Parlin, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,535,438.

Petroleum Refining

Hydrocarbon - Oil Treatment. Gustav Egloff and Harry P. Benner, Independence, Kan., assignors to Universal Oil Products Company, Chicago, Ill., a Corporation of South Dakota.—1,535,653.

Process for Treating Petroleum Oil. Gustav Egloff and Harry P. Benner, Independence, Kan., assignors to Universal Oil Products Company, Chicago, Ill.—1,535,654.

Apparatus for Treating Oil. Gustav Egloff and Harry P. Benner, Independence, Kan., assignors to Universal Oil Products Company, Chicago, Ill., a Corporation of South Dakota.—1,535,655.

Process and Apparatus for Treating Oil. Gustav Egloff and Harry P. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,535,211.

Process for Treating Acid-Sludge Oils. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,535,213.

Process for Treating Acid-Sludge Oils. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,535,656.

Method for Treating Hydrocarbon Oils. Carbon P. Dubbs, Wilmette, Ill., assignor to The Universal Oil Products Company, Chicago, Ill.—1,534,927.

Process for Treating Hydrocarbons. William R. Howard, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,535,725.

Process and Apparatus for Treating Hydrocarbons. William R. Howard, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,535,724.

Apparatus for Converting Hydrocarbon Oils. Robert T. Pollock, Boston, Mass., assignor to Universal Oil Products Company, Chicago, Ill.—1,535,178.

Distillation Apparatus. Gustav Egloff and Harry P. Benner, Independence, Kan., assignors to Universal Oil Products Company, Chicago, Ill.—1,533,173.

Processing Hydrocarbon Lubricating Oils. Henry Guy Fowler, Associated, Calif., assignor to Associated Oil Company, San Francisco, Calif.—1,534,376.

Process of Refining Mineral Oil. Harold T. Maitland, Sharon Hill, Pa., assignor to Sun Oil Company, Philadelphia, Pa.—1,533,325.

Process of Recovering Aluminum Chloride. Almer McDuffie McAfee, Port Arthur, Tex., assignor to Gulf Refining Company, Pittsburgh, Pa.—1,534,130.

Production of Petrol. Frank Tinker, Erdington, Birmingham, England.—1,535,507.

Hydrocarbon Emulsion and Process of Making Same. Charles B. Belknap, Detroit, Mich.—1,533,158.

Method of Treating Oils With Prepared Clays. Irwin Arthur Clark, Parco, Wyo., assignor to Producers and Refiners Corporation.—1,533,060.

Apparatus for Separating Composite Oils Into Component Parts. Frank E. Van Tilburg, Minneapolis, Minn.—1,532,456.

Art of Distilling Petroleum Oils. George H. Field, Whiting, Ind.—1,535,457.

Oil and Gas Separator. David G. Lorraine, Los Angeles, Calif.—1,533,744.

Safety Device for Gasoline Storage Tanks. William E. Durborow, Columbia, Pa.—1,533,587.

Combustion, Furnaces and Refractories

Oil Burner. Aubrey O. Adcock, Kansas City, Mo.—1,533,081.

Oil Burner. Benjamin W. Hurd, San Francisco Calif., assignor to Turbine Fuel Oil Burner Co., San Francisco, Calif.—1,533,420.

Liquid-Fuel Burner for Heating Plants. John E. Erickson and Walter F. Erickson, St. Paul, Minn.—1,531,741.

Liquid-fuel Burner. Lorn Campbell, Jr., Minneapolis, Minn., assignor to United States Welding Company, Minneapolis, Minn.—1,534,295.

Oil Burner. Bruno A. Schaumann, Milwaukee, Wis.—1,531,819.

Burner for Burning Oil Fuel. Percy Sloper, London, Eng.—1,533,042.

Oil Burner. Irving J. Foltz, deceased, late of Seattle, Wash., by Florence O. Foltz, executrix, Seattle, Wash.—1,532,393.

Oil Burner. Matthias H. Reimers, Hoboken, N. J., assignor to W. N. Best Corporation, New York, N. Y.—1,531,877.

Hydrocarbon Burner. Ezekiel Field White, Chicago, Ill.—1,531,587.

Oil Burner. Edwin L. Miller, Kansas City, Mo.—1,533,129.

Oil Burner. Nathan E. Tyrrell, Kansas City, Mo.—1,532,847.

Liquid-Fuel Burner or Atomizer. Cornelis Zulver, London, England.—1,535,886.

Oil Burner. Albert W. Breiding, Eterling, Ill.—1,535,710.

Fluid-Fuel Burner. Henri Leconte and Louis Hirsch, Paris, France.—1,535,166.

Oil Burner. Walter T. Cunningham, Wichita, Kans.—1,535,815.

Oil-Burning Apparatus. Frederick A. Daechsel, Ottawa, Ontario, Canada.—1,532,733.

Pulverized-Fuel-Burning Apparatus. William O. Renkin, Oradell, N. J., assignor to Fuller-Lehigh Company.—1,535,132.

Pulverized-Fuel Burner. David H. Couch, Warwick, R. I.—1,532,041.

Furnace. Carl J. Wright, Toledo, Ohio, assignor to Doherty Research Company, New York, N. Y., a Corporation of Delaware.—1,535,277.

Furnace. John Fitzpatrick, Cincinnati, O., assignor to the Carborundum Company, Niagara Falls, N. Y.—1,532,689.

Tunnel Furnace, Kiln, Oven, and the like. Henri Francart, Tongres, Belgium.—1,531,279.

Furnace for Burning Powdered Fuel. Milton Kraemer, New York, N. Y., assignor or one-half to Edward A. Geoghegan, New York, N. Y.—1,532,103.

Gas Producer. J. Barnes Goodwin, Elko, Nev.—1,532,179.

Gas Producer. Charles W. Lummis, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass.—1,533,931.

Gas Producer. James Harry Lemon, Milltown, Ind., assignor to Louisville Cement Co., Louisville, Ky.—1,533,929.

Gas Producer. Albert L. Galusha, Caldwell, N. J.—1,531,857.

Continuous Process of Making Coke and Illuminating Gas. Herman Burgi, Springfield, Mass., assignor of one-half to Charles Henry Tenney, Springfield, Mass.—1,532,300.

Power Declinkering Apparatus for Gas Generators. Gaston A. Brander, Brooklyn, N. Y.; Lucia R. Brander, administratrix of said Gaston A. Brander, deceased, assignor of one-half to Thomas Costigan, New York, N. Y.—1,535,649.

Process of Disintegrating and Drying Peat. Frederick A. Plummer, Minneapolis, Minn.—1,532,344.

Device for Utilizing the Heat Contained in the Fuel Residues of Furnaces. Christian Christians, Wilmersdorf, near Berlin, Germany.—1,535,765.

Waste-Heat Cooling System for Periodic Clay-Burning Kilns. Royal L. Ash, Bucyrus, O., assignor of one-half to Hans C. Pfund, Des Moines, Iowa.—1,533,999.

Gas-Purification Process. Frederick W. Sperr, Jr., and Ralph E. Hall, Pittsburgh, Pa., assignors to the Koppers Co., Pittsburgh, Pa.—1,533,773.

Refractory Furnace Lining. Daniel H. Meloche, Detroit, Mich., assignor to Earl Holley, Detroit, Mich.—1,534,237.

Refractory Metallic Body of High Density and Process for Making the Same. Clemens A. Laise, Weehawken, N. J.—1,531,666.

Manufacture of Silica Bricks. John Wilson, Crook, England, assignor to John Wilson and Pease and Partners, Limited, both of Darlington, Durham, Eng.—1,534,199.

Inorganic Processes

Refining Crude Arsenious Oxide. Robert Suchy and Josef Michel, Griesheim-on-the-Main, Germany, assignors to the Firm Chemische Fabrik Griesheim Elektron, Frankfurt-on-the-Main, Germany.—1,532,454.

Method of Making the Arsenate of Calcium and Analogous Elements. Joseph F. Cullen, Midvale, Utah, assignor to United States Smelting, Refining & Mining Co.—1,532,577.

Fungicide, Insecticide, and Bactericide Compound. Emil Molz, Halle-on-the-Saale, Germany, assignor to the Farbenfabrik vorm. Friedr. Bayer & Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,532,631.

Process for Synthetic Manufacture of Cyanide. Galen H. Clevenger, Brookline, Mass., assignor to United States Smelting, Refining & Mining Co., Portland, Me.—1,534,054.

Process for Producing the Hydroxides of Alkali Metals or of Alkaline-Earth Metals. Ernst Heinze, Wiesdorf-on-the-Rhine, Germany, assignor to Farbenfabrik vorm. Friedr. Bayer & Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,532,489.

Treatment of Alkali-Metal Chlorides. Julius Kersten, Mannheim, Germany.—1,533,009.

Process of Extracting Mercury from Cinnabar. Edward E. Hedges, New York,

N. Y., assignor to The Hedges New Education Process Corporation, Newark, N. J.—1,535,467.

Process for the Manufacture of White Lead. George Freeman Lloyd, Brighton, and Frank Boardman Clapp and Frederick Harper Campbell, Melbourne, Victoria, Australia, assignors to Commonwealth White Lead and Paints Proprietary, Limited, Brighton, Victoria, Australia.—1,532,419.

Process for the Treatment of Magnesite or Dolomite. George Strike Kilbourn, Owen Sound, Ontario, Canada.—1,532,500.

Process for Refining Zirconium-Containing Ores and Other Products Containing Dioxide of Zirconium. Otto Ruff, Breslau, Germany.—1,535,687.

Process for Bleaching Sulphuric Acid. William Cleland Leonhard, Passaic, John Roy Dufford, Paterson, and Arthur Hough, Summit, N. J.—1,534,226.

Spray Mixture and Process of Making the Same. Carl F. Galligan, Berkeley, Calif., assignor, by direct and mesne assignments, to F. A. Frazier Company, San Francisco, Calif.—1,535,525.

Manufacture of Lithopone. James Elliot Booge, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,535,760.

Method of Condensing Zinc Vapors. Oystein Ravner, Christiania, Norway, assignor to Det Norske Aktieselskab for Elektrokemisk Industri, Christiania, Norway, a Business Entity, Christiania, Norway—1,535,252.

Process of Producing Chromic-acid Solutions. Arthur W. Burwell, Poughkeepsie, N. Y.—1,535,100.

Iodine and Process of Making the Same. Wallace L. Chandler, East Lansing, Mich.—1,535,450.

Process of Extracting Sulphur from its Ores. Edward E. Hedges, New York, N. Y., assignor to The Hedges New Education Process Corporation, Newark, N. J.—1,535,468.

Process of Carbonating a Liquid. Henry C. Parker, Chicago, Ill.—1,534,806.

Manufacture of Nitrogen. Ferdinand A. Rudolf, Jamaica, N. Y., assignor to Gerald M. Livingston, trustee.—1,531,571.

Process for the Treatment of Leucite. Birger Ejeld Halvorsen, Christiania, Hans Joachim Falck, Notodden, Thor Mejell, Skolen, near Christiania, and Oystein Ravner, Christiania, Norway, assignors to Norsk Hydro-Elektrisk Kvaalstofaktieselskab, Christiania, Norway.—1,531,336.

Coagulant for Purifying Water and Process of Purifying Water therewith. Lewis Miller Booth, Plainfield, N. J.—1,535,709.

Method and Means for Purifying Water. William H. Walker, Bridgton, Me., assignor by mesne assignments, to Elliott Company, Pittsburgh, Pa.—1,533,778.

Method of Bleaching Barytes. Willis F. Washburn, St. Louis, Mo., assignor to National Pigments & Chemical Company, St. Louis, Mo.—1,533,779.

Method of Removing Free Oxygen from Water. Frank N. Speller, Pittsburgh, Pa.—1,531,989.

Dyes and Organic Processes

Dyestuff. Guillaume de Montmollin and Gérard Bonhôte, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basle, Switzerland.—1,534,506.

Pyrone Dye. Max Weiler, Elberfeld, Germany, assignor to Farbenfabrik vorm. Friedr. Bayer and Co., Leverkusen, near Cologne-on-the-Rhine, Germany.—1,532,790.

Process for the Preparation of Aminoazo Compounds. Karl Heusner and Max Simon, Leverkusen, near Cologne - on - the - Rhine, Germany, assignors to Farbenfabrik vorm. Friedr. Bayer & Co., Leverkusen, near Cologne - on - the - Rhine, Germany.—1,532,627.

Sulphur Dyes. Oskar Spengler and Alfred Thurm, Dessau, Anhalt, Germany, assignors to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany.—1,532,640.

Treatment of Cellulose Esters for Dyeing. Richard Metzger, Heidelberg, Germany, assignor to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,532,427.

Art of Reducing Indigo Dyes and other Solutions. Frederic Augustus Eustis, Milton, Mass.—1,535,151.

Decolorizing Carbon and Process of Producing the same. Leonard Wickenden, Flushing, N. Y., assignor to Industrial Chemical Company, New York, N. Y.—1,535,798.

Tanning Agent. Franz Hassler, Volksdorf, near Hamburg, Germany—1,533,594.

Production of Glycol Esters. Philip B. Watson, Flushing, N. Y., assignor to Carbide and Carbon Chemical Corporation.—1,534,752.

Process for the Manufacture of Acetaldehyde. Marcel Jean Louis Ledru and Edouard Joseph Bachmann, Roussillon, France, assignors to Societe Chimique des Usines du Rhone, Paris, France.—1,532,190.

Manufacture of Soap. Victor Hugo Gottschalk, Chicago, Ill., assignor to The American Cotton Oil Company, New York, N. Y.—1,532,693.

Process for Producing Nonperoxidizable Ether. Dirk Roelof Nijk, Leiden, Netherlands, assignor to Naamlooze Venootschap, Nederlandsche Gist en Spiritusfabriek, Delft, Netherlands.—1,532,772.

Method of Forming a Phenolic Condensation Product. Edwin Rolker, Baltimore, Md., assignor to The Permatite Company.—1,532,952.

Manufacture of Chloroform. George A. Richter and Wallace B. Van Arsdel, Berlin, N. H., assignors to Brown Company, Berlin, N. H., a Corporation of Maine.—1,535,378.

Alcoholic Solution of Animal Proteins and Method of Preparing the same. David Thomson, London, England.—1,532,521.

Manufacture of Benzaldehyde-2,5-Disulfonic Acid. Benjamin Rosenbaum, Buffalo, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,531,507.

Process for Manufacturing Hydroquinone. Hermann Ende, Berlin-Lankwitz, Germany, assignor to Chemische Fabrik auf Actien (vorm. E. Schering), Berlin, Germany.—1,532,800.

Thiocarbanilide Derivative. Clayton W. Pedford, Akron, Ohio, and Robert L. Sibley, Elizabeth, N. J., assignors to The Goodyear Tire & Rubber Company, Akron, Ohio.—1,532,646.

Process of Producing Formic-acid derivatives. Kurt Meyer, Mannheim, and Ludwig Orthner, Freiburg-Breisgau, Germany, assignors to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Bavaria, Germany—1,532,428.

Sulphurized Chemical Product. Walter O. Snelling, Allentown, Pa.—1,535,740.

Decolorizing Carbon and Process of Producing the Same. Leonard Wickenden, Flushing, N. Y., assignor to Industrial Chemical Company, New York, N. Y.—1,535,797.

Process for the Preparation of Alkyamine Salts of the 4-Hydroxy-3-Acylaminophenylarsonic Acids. Jean Altweig, Lyon, France, assignor to Societe Chimique des Usines du Rhone, Paris, France—1,532,561.

Detergent. Josef Hans Weiss, Brooklyn, and Robert Wotherspoon, Jamaica, N. Y., assignors to Orbin Products Trading Co., Inc., New York, N. Y.—1,531,324.

Process for the Preparation and Reactivation of Metallic Catalysts used in the Hydrogenation of Oils and Like Substances. Ernest Joseph Lush, London, England, assignor to Technical Research Works Limited, London, England.—1,533,932.

Process for the Manufacture of 1-Phenyl-2,3-Dimethyl-4-Dimethylamino-5-Pyrazolone. Julius Hoffmann, Hongg, near Zurich, Switzerland.—1,531,286.

Method of Treating Waste of Benzol Recovery. Fred W. Wagner, Pittsburgh, Pa., assignor to Jones & Laughlin Steel Corporation, Pittsburgh, Pa.—1,534,554.

Electrolytic Cells and Processes

Electrolytic Production of Aluminum. Francis C. Frary, Oakmont, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.—1,534,031.

Method of and Apparatus for Electrolytic Refining. Francis C. Frary, Oakmont, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa., a Corporation of Pennsylvania.—1,535,458.

Electrolytic Production of Magnesium. William G. Harvey, Niagara Falls, N. Y., assignor to American Magnesium Corporation, Niagara Falls, N. Y.—1,533,911.

Process for the Electrolytical Production of Cyanates from Cyanides. Otto Liebknecht, Frankfort-on-the-Main, Germany, assignor to the Roessler & Hasslacher Company, New York, N. Y.—1,531,863.

Process for Electrolytically Depositing Elemental Chromium Upon Metals. Samuel Peacock, Wheeling, W. Va.—1,535,339.

Electrolytic Process. Hans Gerdien, Berlin-Grünewald, Germany, assignor to Siemens & Halske Aktiengesellschaft, Siemensstadt, near Berlin, Germany.—1,531,386.

Process of Producing Alkali Metals. Samuel Peacock, Wheeling, W. Va., assignor to Willis G. Waldo, Washington, D. C.—1,531,623.

Battery Cell. Robert Stuart Owens, Brooklyn, N. Y.—1,534,656.

Dry-cell Battery. Harry M. Koretzky and Boris H. Teitelbaum, Brooklyn, N. Y.; said Teitelbaum assignor to said Harry M. Koretzky and Israel Koretzky, New York, N. Y.—1,533,012.

Chemical Engineering Equipment

Rotary Drying Apparatus. Frederick T. Greaves, Chicago, Ill.—1,531,780.

Rotary Drier. William A. Harty, Blasdell, N. Y., and Frank W. Moore, Thorold, Ontario, Canada.—1,531,438.

Rotary Kiln. Ellis C. Kent, Brooklyn, N. Y., assignor to Robert Sayre Kent, Inc.—1,533,866.

Drying Apparatus. Lars H. Bergman, Chicago, Ill., assignor to Raymond Bros. Engineering Co., Chicago, Ill., a Corporation of Illinois.—1,535,804.

Drier. Gustav Komarek, Chicago, Ill., assignor, by mesne assignments, to Malcolson Engineering and Machine Corporation, St. Louis, Mo.—1,534,180.

Drying Apparatus. Joseph G. Coffin, Hempstead, N. Y., assignor to The General Rubber Co., New York, N. Y.—1,534,030.

Apparatus for Drying, Burning, and Recovering Finely Divided Materials. Johan Nicolaas Adolf Sauer, Amsterdam, Netherlands.—1,535,949.

Heat Exchanger. James A. Stairs, Pittsburgh, Pa., assignor to the Calorizing Co., Pittsburgh, Pa.—1,535,351.

Heat Interchanger. Norris H. Frost, West Hoboken, N. J.—1,531,777.

Heat Exchanger. Boyd M. Johnson, Metuchen, N. J., assignor to the Carborundum Co., Niagara Falls, N. Y.—1,531,400.

Crusher. Arthur J. Jorgensen, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—1,533,991.

Rock Crusher. Alvah D. Hadsel, San Francisco, Calif., assignor of one-half to Frederick N. Woods, Jr., San Francisco.—1,532,742.

Crusher. Edward H. Frickey, St. Louis, Mo., assignor to Dixie Machinery Manufacturing Co., St. Louis, Mo.—1,531,856.

Crusher. Ray C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—1,533,658.

Pulverizer with Pendular Rollers. Paul Vérola, Paris, France, assignor to Société Anonyme pour l'Utilisation des Combustibles, Paris, France.—1,531,462.

Mill for Grinding Paints, Enamels, Inks, and Other Viscous Materials. Sidney Smith, Midhurst, England.—1,535,052.

Ball-Mill Lining. Raymond H. Baker, New York, N. Y., assignor to Taylor-Wharton Iron and Steel Co., High Bridge, N. J.—1,534,000.

Method and Apparatus for Enameling Brick or Tile. John Frances Booraem, Greenwich, Conn.—1,531,839.

Brickkiln. John F. Sherbahn, McCook, Neb.—1,535,260.

Tar Extractor. Lewis C. Bayles, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J.—1,532,118.

Apparatus for Liquefying Chlorine Gas. William M. Jewell, Chicago, Ill., assignor to Chlorine Products Co., Chicago, Ill.—1,532,109.

Liquid Meter. Paul Bailey, Berkeley, Calif.—1,532,295.

Rust-Resisting Mild Steel and Process of Rusting the Same. Samuel Peacock, Wheeling, W. Va., assignor to Wheeling Steel Corporation, Wheeling, W. Va.—1,535,340.

News of the Industry

Ethyl Gasoline Subject for National Conference

Surgeon General of U. S. Public Health Service Will Conduct Conference at Washington on May 20

Every phase of the possible hazard to the public health from the manufacture, distribution and use of ethyl gasoline is to receive attention in a national conference in Washington, D. C., called for May 20 by Surgeon General Hugh S. Cumming of the U. S. Public Health Service. This action, precipitated at this time largely as a result of a sensational crusade on the part of a New York newspaper and widely published differences of opinion among several scientists and physicians, is said to be in keeping with the Surgeon General's original plan to bring together for study and interpretation the results of the several investigations made of this subject by the U. S. Bureau of Mines, the College of Physicians and Surgeons of Columbia University and in the laboratories and plants of the manufacturers and distributors.

In his announcement to the press, Surgeon General Cumming stated that the personnel of the conference would consist of physicians, pathologists, health authorities and representative chemists and engineers. Among those asked to attend are Dr. Yandell Henderson, of Yale, Professor of Applied Physiology, Dr. David L. Edsall and Dr. Cecil K. Drinker, of the faculty of the Harvard Medical School, Professor C. E. A. Winslow, of Yale Medical School, Dr. William Henry Howell, physiologist of the School of Hygiene at Johns Hopkins University, Dr. Haven Emerson, Columbia University, Dr. William A. Pusey, President of the American Medical Society and Dr. Emory R. Hayhurst, Professor of Hygiene at Ohio State University.

Officials of the Bureau of Mines, the Chemical Warfare Service, Dr. Frederick B. Flinn, Assistant Professor of Physiology at Columbia University and others who have conducted investigations into the subject will be asked to testify. The American Automobile Association, the National Safety Council and the American Federation of Labor will send representatives. None of the national chemical or engineering societies were included in the original invitations sent out by the Public Health Service. State and City Boards of Health were asked to send representatives.

On May 5, following the calling of the conference by the Surgeon General,

the Ethyl Gasoline Corporation voluntarily suspended all deliveries of tetraethyl lead for resale to the public in ethylized gasoline. In explanation of this action the manufacturer stated:

"The purpose of the stockholders of the Ethyl Gasoline Corporation in entering upon the development of this discovery was to accomplish universal distribution of a more efficient motor fuel, the aim being the production and sale of an improved automobile engine capable of operating on this fuel and of giving a better performance and an increase of mileage per gallon greatly in excess of that now being realized.

"Years of research work preceding the discovery of this product, followed by relatively small-scale use during the past two years, have been directed toward this end. In this distribution and use there have been no indications of injury to health. On the contrary, the most careful field examinations of men engaged in handling ethyl gasoline, coupled with the scientific studies in our laboratories, were entirely favorable."

Dominion Paper Interests Aid Government in Research

The Canadian Pulp and Paper Association, which has taken a leading part in promoting industrial research in connection with the paper industry, has just entered into a special arrangement with the Dominion Government for the joint operation and control of the Pulp and Paper Division of the Forest Products Laboratories, established and maintained by the government in Montreal. Under this arrangement the association assumes certain financial responsibilities in relation to the employment of a director of the division and of members of his staff, and in return is given a large degree of control in the direction of the division and in the choice of the program of work to be undertaken.

Strontium Nitrate Will Not Be Investigated

Conditions surrounding strontium nitrate are not such as to justify an investigation of that commodity, the Tariff Commission believes. As a result no action will be taken at this time in connection with the application to increase the duty under the flexible provisions of the tariff act. An ad valorem duty of 25 per cent now applies to this commodity.

Fertilizer Interests Form New Association

Consolidation of the National Fertilizer Association and the Southern Fertilizer Association was assured when members representing a large proportion of the tonnage voted for the merger at a meeting in Washington, April 23 and 24.

The principal reason for merging the two associations is to eliminate duplication of effort. Most problems of the fertilizer industry are common to each association. By combining these activities money will be available for more work. By having a Washington office southern members will be able to have their traffic matters handled more promptly and at less expense.

With the increased resources which the consolidation will provide the work which the Soil Improvement Committee has been doing can be expanded. Greatly extended statistical and research activities also can be undertaken. Fellowships at both northern and southern schools will be provided. Close cooperation with the Manufacturing Chemists' Association will be continued, but the fertilizer association will engage its own executive secretary.

The work incident to the perfection of the new organization is to be conducted by committees in the consuming territory which has been allotted to nine groups. Final action on the consolidation will be taken at the joint annual meeting of the two associations at White Sulphur Springs in June. The merger will adopt the name of the northern association and be known as the National Fertilizer Association.

Dr. S. C. Lind Joins Department of Agriculture

Dr. S. C. Lind, Chief Chemist of the Bureau of Mines, since 1923, has resigned to become Assistant Director of the Fixed Nitrogen Laboratory of the Department of Agriculture. The radium work of the Bureau of Mines has been turned over to the Fixed Nitrogen Laboratory so that it may continue under Dr. Lind's direction.

Dr. Lind is regarded as one of the government's best research chemists. In addition to his work on radium, Dr. Lind has become known widely for the work he has done on helium. He was in charge of the Rare Metals Station of the Bureau of Mines at Reno for two years. He has been a member of the staff of the Bureau of Mines since February 26, 1913.

News in Brief

A. S. T. M. to Establish Annual Medal and Lecture—The executive committee of the American Society for Testing Materials will recommend, to the Society at the annual meeting to be held in Atlantic City in June, the establishment of an annual medal and lecture. It is proposed that the medal shall take the name of Charles B. Dudley, first president of the Society and that the lecture shall commemorate the name of Edgar Marburg, first secretary of the Society.

Canadian Newsprint Production Again Increased—Canadian newsprint production in March again showed an increase over any previous record. The output was 126,267 tons, compared with 113,192 tons for March of last year. For the first quarter of 1925 Canadian production exceeded that of last year by 27,000 tons, or 8 per cent. With new machines coming into operation almost immediately, a much greater newsprint output is looked for. The Fort William Paper Co. has just started a new machine, while before the end of May the E. B. Eddy Co.'s new machine will be in operation.

German Metal Firms Turn To Chemicals—Reports from Berlin state that owing to decrease in sales of metals, some of the larger metal firms are turning their attention to the production of chemicals.

Larger Fertilizer Tonnage in 1924—Official tonnage figures from 24 of the larger fertilizer-using states indicate that the total tonnage for all states in 1924 was over 7,000,000 tons, as compared with 6,647,000 tons in 1923. The comparison is misleading because of the higher grade goods sold in 1924. If it were possible to report on the plant-food units in the past two years, it is extremely probable that the increase for 1924 over 1923 would be at least 25 per cent.

Court of Chemical Achievement—The time during which applications for products or processes believed to be sufficiently outstanding to be admitted to the Court of Achievement of the Tenth Exposition of Chemical Industries to be held September 28-October 3rd at Grand Central Palace, New York, has been extended to June 1st. This extension has been granted because more time has been requested by the directors of research in the laboratories of industries, government bureaus, and educational institutions to choose from their work special items for the consideration of the committee.

Federal Coking Plants Proposed for Eastern Canada—Legislation is to be submitted shortly in the Canadian House of Commons, providing for the establishment of coking plants at various centers in Eastern Canada including Montreal, Que. and St. John, N. B. The plan will be similar to that in Hamilton, Ont., where a federal coking plant has produced satisfactory results. The proposal will involve federal monetary aid, taking the form of what will in reality be a bounty, as the aid

given will be based on the tonnage production of coke.

Utilizing Waste Products of the Corn Crop—The remarkable progress made in utilizing waste products from the corn crop, such as corn cobs, stalks, and leaves, is indicated in a report issued by the Department of Agriculture. The list contains 146 commodities, including such items as axle grease and face powder, shoe heels and chair cushions, cigarette holders and gun powder, incense and punk, phonograph records and shaving soap, shoe horns and varnish. The list of commodities ranges from absorbents for nitroglycerine in the manufacture of dynamite to xylose, a kind of sugar.

Large Sales of German Potash—Sales of the German potash syndicate for the first four months of 1925 totaled 580,000 tons. This is more than double the amount marketed during the corresponding period of last year.

Convention of French Chemical Industry To Open Sept. 27

The Fifth Convention of the French Chemical Industry will begin in Paris on Sept. 27 and will close with a trip to Frenoble to visit the International Exposition of Water Power and to various plants in that region, according to the Department of Commerce.

Following the precedent of the previous convention, while considering the problems of the various branches of the industry, special general meetings are planned in which foreign as well as French leaders of industry and science will participate. These special meetings this year will be devoted to the fuel and metallurgical industries and 2 days will be given over entirely to these conferences.

The technical sessions will be divided into 6 groups as follows: (1) Factory and laboratory; (2) fuels; (3) metallurgical and mineral industries; (4) organic industries; (5) agronomy and agricultural industries, and (6) economic organization.

This convention, like the previous conferences, will be held under the auspices of the Industrial Chemical Society (Societe de Chimie Industrielle), 49 Rue Des Mathurins, Paris. The president of the permanent committee of organization for the convention is Jean Gerard, and the president of scientific and technical committee is Leon Guillet, both of whom may be reached at the above address.

Colloid Chemists Will Hold Symposium in June

The third national colloid symposium will be held at the University of Minnesota June 17, 18 and 19, under the chairmanship of Prof. Harry N. Holmes. In all, 21 papers are planned, some of the outstanding topics being: "The Orientation and Distribution of Molecules," by Irving Langmuir, General Electric Co.; "Adsorption," by Herbert Freundlich, Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry; and "The Plasticity Problems of Rubber," by W. J. Kelley, Goodyear Tire & Rubber Co.

Hoover Calls Advertising Vital Force in Industry

At the annual convention of the Associated Advertising Clubs of the World, which opened at Houston, Texas on May 11, Secretary Hoover was one of the principal speakers. In part he said: "I should not wish to let the occasion go by without some observations on the fundamental part that advertising plays in the life of our modern world. It has truly become one of the vital forces in our entire industrial and commercial system. And beyond this, it has in its repercussions set many currents moving of wider influence than even the economic life of our people. It is now fixed as an integral part of this complex of civilization which we have built up."

"No matter how fine an addition to human comfort or pleasure a given article or service may be, unless there is a diffusion of knowledge and information with respect to it, it will not itself become quickly accepted and incorporated into our standards of living. Our standards of living are much higher today than they would have been were it not for the part played by advertising."

"One profound economic effect of advertising is oftentimes overlooked—its influence up production. The general knowledge and rapid distribution of an article, which can only be accomplished through advertising, creates large production and thus lower costs and prices. Modern advertising is the hand-maiden of mass production. Moreover, your convincing announcements of a multitude of improvements on everything spreads a restless pillow for every competitor and drives him to further and faster exertions to keep apace."

Government Wins Suit To Hold Phosphate Lands

The United States Supreme Court, on May 4 denied a writ of certiorari by which the Charleston, S. C., Mining & Manufacturing Co. sought to have it review a decision of the lower federal courts in a suit by the United States involving title to phosphate lands in Florida. The State of Florida in 1906 filed on public lands under the indemnity school selection act of 1845. Its selection was approved by the Secretary of the Interior. The State then sold part of the lands to the Charleston, S. C., Mining & Manufacturing Co. Subsequently, the government filed suit to have the sale set aside on the ground the lands had been selected as agricultural land whereas they contained valuable phosphate deposits and hence were not subject to such selection. The company resisted the suit, declaring the transfer to Florida was regular and that its purchase from the State had been in good faith and could not be revoked. It also contended that the statute of 1845 was enacted long before phosphate deposits were recognized as mineral deposits. The lower courts held for the government in the suit. By the refusal of the Supreme Court to review the case, this decision will stand, and these lands will again come under government control.

News from Washington

By Paul Wooton

Washington Correspondent of *Chem. & Met.*

MORE significance is attached in Washington to late chemical developments than to the German election or the return of Great Britain to the gold standard. The development of a synthetic alcohol which carried down a great American industry overnight has come in for active discussion from cabinet members down through all branches of the government establishment. None has been more interested than the financial specialists. It is recognized that this development is certain to influence credit policies in an important way.

Technical men in the government service see in this spectacular incident the creation of a new appreciation of research on the part of the people and of Congress. They regret the heavy losses that have been occasioned, but they believe the country as a whole will be aroused to the need of continual research in all lines of endeavor and particularly in chemical endeavor. An expansion of the government's research work is expected to result, but the general opinion is that the more important result will be the undertaking of scientific programs by private industry generally.

Synthetic Methanol

While the commercialization of synthetic methanol came suddenly, the Department of Commerce feels proud that it was in a position as long ago as Aug. 4, 1924, to publish a comprehensive report of the process, which is regarded as an outgrowth of the work on the fixation of atmospheric nitrogen and is indicative of the concentration of chemical interests on the field of gases. While there is no thought that development will slacken in the work on solids and liquids, it is thought that gases offer a more promising opportunity for major developments.

There is reason to believe that the production of other alcohols through the application of the same principles is under way in Germany. Unquestionably these developments bring a process of gas synthesis within hailing distance of the great market offered motor fuels.

There is some difference of opinion as to the patent situation involved. One large American concern is understood to have made an arrangement with the Badische Company conditioned upon an investigation of the patent situation. After the investigation the contract was cancelled by cable.

In this connection it is known that importance is attached to the Jaeger patents taken out in this country in November 1923, by Dr. A. O. Jaeger and Dr. Bertsch, now in the service of the National Aniline and Chemical Co. of Buffalo. Because of the patent situation it is said that the Badische Company is not anxious to enter into contract with any American concern.

For the moment chief attention in the Muscle Shoals matter has been focused on the power side of the question as a result of the interruption of the War Department's plans for the temporary distribution of the power. Nevertheless the month saw the putting forward of a plan to which importance is attached.

Muscle Shoals Plans

There are half a dozen processes of promise under development in the laboratories of the world. The government, according to this plan, would furnish a site and the necessary power to these inventors in the hope that it will help to demonstrate what can be done with their processes when operated on a commercial scale. Free power would be furnished for five years. After that time the concerns would be required to buy their own power. This would carry with it, however, rights to continue thereafter the use of the plant and assurances of ample power at reasonable rates. The thought is that any process with commercial possibilities would be self-supporting after five years and able to pay for its power.

No provision for the limitation of profits is believed necessary. If anyone develops a process that can produce nitrogen cheaper than the natural product can be laid down in our markets, operations will spring up elsewhere than at Muscle Shoals, and competition will insure reasonable prices. Limitation of the profits of such an enterprise by legislative enactment is the conception of the demagogue.

To hold out inducements which will encourage those engaged in promising research has much greater possibilities of bringing forth practical results than has a great government experimental plant. This latter plan, calling for \$5,000,000 would mean that a \$7,500 man, all the salary Congress likely would approve, would select the process and conduct the work under all the limitations and handicaps which surround a politically chosen administrator.

The fertilizer industry is squarely behind the suggestion that Muscle Shoals be made a great center for private experimentation with nitrogen fixation processes. Gustavus Ober, of Baltimore, the President of the National Fertilizer Association, thinks the one way to insure maximum benefits for agriculture would be to encourage research and experimentation until some process is brought definitely and clearly into a commercial stage.

With all other industries the fertilizer producers have a higher respect for the practical possibilities of research since the wood alcohol industry received its jolt. For that reason they are more anxious than ever to see the various inventors of processes encouraged to work intensively for improvement, but

the expectation is that once a process is perfected it will be put to use at any well located point.

New Nitrate Process

Fully a year and a half must elapse before the new Guggenheim process of treating nitrate of soda can be placed in operation on a commercial scale. While the new plant is being constructed, operations will continue in the plants of the Anglo-Chilean Nitrate and Railroad Company, the British concern which the Guggenheim interests acquired early this year. The company name has been changed somewhat and now is "The Anglo-Chilean Consolidated Nitrate Company."

The Guggenheims were influenced to undertake this large operation, which will produce one-eighth of Chile's output of nitrate when the new plant will have been completed, by the promising prospects of the new process. This process, which has been under development for several years, is said to make possible recoveries as high as ninety-five per cent. In addition less power, labor and water are required.

The properties taken over by the new company include the narrow gauge railroad, 100 miles in length, connecting the plants with tidewater at Tocopilla. The Chile Exploration Company operates a large plant at this port which furnishes the power for its copper properties.

While the new company is controlled by the Guggenheim brothers, no one of them is an officer of the company. Three of them are directors, however, while two are members of the executive board. E. A. Cappelen Smith, who has been closely associated with the development of the new process, is president. J. K. MacGowan and Paul H. Mayer are vice-presidents, and W. E. Bennett is secretary and treasurer.

Death of Dr. Day

Death has removed from the scene David Talbot Day, who for forty-five years had been an active figure in geological circles. His death occurred in Washington, April 15. Funeral services were held in the same city April 18, with interment at Baltimore.

Dr. Day was the father of the Minerals Resources Division of the United States Geological Survey. When he became a member of the Survey in 1886, statistics of mineral production were obtained from secondary sources. He organized the work and established the policy of close personal contact between the technical men at the Survey and the producers of minerals.

In 1914 Dr. Day was appointed a consulting chemist on the staff of the Bureau of Mines. His work on the Rittman process of petroleum refining attracted wide attention. He also did extensive work for the Bureau of Mines on oil shale. In connection with his Bureau of Mines work he did a general practice as a petroleum geologist.

During his career Dr. Day gave generously of his time and money in behalf of public spirited enterprises. For many years he was secretary of the Joseph A. Holmes Safety Association. He served without salary and traveled extensively in an effort to arouse interest in that organization.

Fused Electrolytes Discussed at Spring Meeting of A. E. S.

Officers Were Elected for the Ensuing Year and Chattanooga Was Selected as Meeting Place Next September

THE 47th meeting of the American Electrochemical Society was held at Niagara Falls, April 23, 24 and 25, with headquarters at the newly completed Hotel Niagara. Over 300 members and guests were registered and the meeting was the largest held for several years.

At the annual business meeting the following officers were elected: President, F. M. Becket; vice-presidents, William Blum, F. C. Frary and E. F. Cone; managers, H. W. Gillett, F. N. Speller and J. W. Bain; treasurer, Acheson Smith, and secretary, Colin G. Fink. The Council appointed H. C. Parmelee as the Society's representative on the National Research Council for the ensuing three years. Wilder D. Bancroft, professor of physical chemistry in Cornell University, and a charter member of the Society, was elected to honorary membership. The next meeting of the Society will be held at Chattanooga, Tenn., Sept. 24, 25 and 26, the technical feature of which will be a symposium on the electrochemistry of fertilizer materials.

The principal feature of the technical session at the Niagara Falls meeting was a symposium on the production of metals by the electrolysis of fused salts, this being the process by which such metals as aluminum, magnesium, beryllium, zirconium and cerium are obtained. The symposium was under the direction of W. G. Harvey, vice-president of the American Magnesium Corporation. Dr. Frary, of the Aluminum Co. of America, described for the first time the method of preparing aluminum 99.98 per cent pure. A round table discussion on teaching electrochemistry, under the direction of Prof. O. P. Watts, of the University of Wisconsin, attracted a large attendance and was participated in by leading educators and industrialists.

Among the features of popular interest was an illustrated lecture on amateur cinematography by Dr. C. E. K. Mees, director of research for the Eastman Kodak Co. A five-reel film on the production and fabrication of copper was shown through the courtesy of the Anaconda Copper Co. Dr. C. G. Fink gave a brief illustrated talk on his electrochemical method of restoring ancient corroded bronzes.

Perhaps the greatest interest centered in the exhibit of the Niagara Falls Power Co.'s large model of Niagara Falls, which has been constructed for the purpose of conducting experiments in stream control by various methods of water diversion. Contours of the model were taken chiefly from government surveys, although aerial photography was used to advantage in the construction work. The model is constructed to scale in every respect. Water is caused to flow in volume proportionate to the actual flowage in the Niagara River, and the quantity passing over the cataracts may be varied by increasing or decreasing the discharge through intakes located in the respective positions of the present power plant intakes.

Two methods of stream control can be demonstrated on the model. The first makes use of submerged weirs, which have been proposed by U. S. Army engineers, while the second involves the use of islands as suggested by the Queen Victoria Niagara Falls Park Commission. The Niagara Falls Power Co. is willing to place the model at the disposal of government commissions, civic bodies or engineering organizations that may desire to conduct experiments for the purpose of determining how to use the greatest amount of water for power purposes consistent with preserving the scenic beauty of the Falls. Some form of



F. M. Becket, President,
American Electrochemical Society

Mr. Becket is chief metallurgist of the Union Carbide and Carbon Research Laboratories, Inc. He was Perkin medalist in 1923, receiving the award for his extensive work in electrometallurgy, particularly for his discovery and development of a process of reducing ores by silicon. He was the first producer of ferro-vanadium on a commercial scale and had played a large part in developing the utility of chrome iron alloys. It is indicative of his activity that the U. S. Patent Office has issued to him over 60 patents on processes for manufacturing ferro-alloys, calcium carbide and related products. He is a charter member of the American Electrochemical Society, having joined April 3, 1902.

stream control is advisable in order to reduce the present rate of erosion of the Horseshoe at the rate of 6 ft. per annum, regardless of further diversion of water for power purposes. The Niagara Falls Power Co. has prepared an illustrated booklet on the subject which it will be pleased to send to members of the Society on request.

Airplane View of Niagara Falls

Airplane view of Niagara Falls in 1923. About 6 per cent of the flow passes over the American Falls and 94 per cent over the Horseshoe Falls. Nearly 85 per cent of the flow over the latter is concentrated in the middle third of the horseshoe, resulting in erosion that has caused a recession of the cataract of about 900 ft. since the survey of 1764.



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Rules for Prevention of Dust Explosions in Starch Works

The Committee on Dust Explosion Hazards, of which D. J. Price is chairman, reported on May 13 to the National Fire Protection Association a proposed set of regulations for the prevention of dust explosion in starch factories. The hazards involved are particularly those in handling dry starch either at the drying kilns or in packing after drying.

The committee report points out that "it is now generally accepted that any kind of starch dry enough to float in air, is dry enough to contribute to an explosion, even though the department may be one in which the air is quite humid."

The rules also govern certain explosion hazards involved in handling the corn previous to milling and to the milling operations, but these rules are identical with the requirements for grain elevators and flour mills previously adopted.

Copies of the regulations as adopted at the convention are available from the headquarters of the Association, 40 Central Street, Boston, Mass.

Industrial Changes Add to Cost of Nitrate of Soda

Revolutionary industrial changes are accompanying the political convulsions in Chile. These changes are certain to have far-reaching effects which will be felt in this country. While nitrate of soda and copper are the two Chilean products in which the United States has greatest interest trade with the southern republic involves a long list of imports and exports.

Model of Niagara Falls

Model of Niagara Falls constructed by the Niagara Falls Power Co. to study stream control and effect of water diversion by means of submerged weirs and islands. Concrete blocks used for this purpose are visible on the large island and in the right foreground. Two wires down stream from Horseshoe Falls locate the crest of the horseshoe as shown by surveys in 1764 and 1842.

A new code of labor legislation was put into effect March 26 by executive decree. In addition to providing overnight for radical changes, the new code is said to have been formulated in haste and promulgated without hearings or consultation with employers.

The new legislation will add no less than a shilling to each quintal of nitrate, it is declared. It provides, among other things, that all plants must be unionized. Employers are precluded from dealing with their workers except through the organization. Each employer must pay into a pension fund an amount equal to two and one-half per cent of the payroll. The employees also must contribute two and one-half per cent of their wages to the same fund.

Program Completed for National Lime Association Convention

The program has been completed for the seventh annual convention of the National Lime Association which will be held at Briarcliff Lodge, Briarcliff Manor, N. Y., May 26-29. Of primary importance on the program is the Second Annual Research Conference which is scheduled for Tuesday evening, May 26. This will consist of a round table meeting of lime technical men, plant chemists, superintendents and manufacturers.

University of Buffalo Drops B. S. Degree

The University of Buffalo, N. Y., has decided to abolish the degree of bachelor of science and this will no longer be conferred by the institution. A two semester course in introduction to exact science and social science has been established. The general science course will hold sessions four times a week for two semesters a year. The first term, under the supervision of Dr. Edward Moore, will be devoted to natural sciences, including a survey of chemistry, physics, biology and astronomy.

Technical Men at Chemical Equipment Exposition

One of the most distinctive features of the Chemical Equipment Exposition, Providence, R. I., June 22-27, inclusive, is the emphasis it places on the presence of technical men in its booths.

Questions involving the most specialized engineering knowledge will be answered readily by the technical representatives whom exhibiting companies, practically without exception, will have in charge of their displays.

University Ceramic Department Destroyed by Fire

Fire, recently, destroyed a large portion of the engineering building at the University of Saskatchewan, with loss including practically the entire ceramic department of the institution; the kiln house was saved. The department has been in charge of Professor W. G. Worcester, for some time. Plans are said to be under way for the rebuilding of the structure.

Canadian Company Will Develop Tar Sands

Officials of the Anglo-Canadian Collieries and Refineries Ltd., a company formed some time ago with the object of developing the Northern Alberta tar sands on a commercial scale, state that they are making preparations to start operations this spring. The company is backed by Alberta capital and has acquired the Canadian rights for a German process of extracting the bitumen from the sand.

Lazote, Inc., Will Build New Plant at Charleston

Lazote, Inc., recently organized as a subsidiary of E. I. duPont de Nemours & Co., Wilmington, Del., has acquired property at Charleston, W. Va., as a site for the construction of a new plant for the manufacture of synthetic ammonia, under the Claude process.



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British Heavy and Fine Chemical Industries Expand

Production of Synthetic Ammonia Increasing—New Plant for Manufacture of Soda Products—Larger Export Trade in Chemicals

From our London Correspondent

THE leading firms both in the heavy and fine chemical trades are showing good results and extensions are in progress. Brunner Mond's output at the Billingham synthetic ammonia factory is still increasing and a new soda factory at Wallerscote is approaching completion. The United Alkali Co. is planning extensions in its organic and dyestuffs intermediates section, and Nobel Industries, Courtaulds and many others are doing well. It only needs agreement and a saner labor view in the basic industries, cotton, coal, woollens, shipbuilding and steel, to turn the scale definitely towards real recovery. Six months ago such a revival was a pious hope or intelligent forecast which did not materialize—now the worst really seems over and substantial progress is expected for the remainder of the year.

Apart from business prospects there is good reason for advising American executives to plan a visit to Europe this year. The American Institute of Chemical Engineers is setting a good example and the preparations for its reception are already well advanced. Leeds, where three days will be spent at the annual meeting of the Society of Chemical Industry, may possibly prove disappointing as an industrial center but Scotland, Cheshire and London with its second edition of the Wembley Exhibition, will be well worth while. At Leeds the technical symposium will be of exceptional interest.

Developments and Inventions

The number of beet sugar factories will be increased from 3 to 20 during the next year or two and the sugar refiners, after bitter controversy, have also decided in their own interest to play their part. Alcohol production in connection with the sugar factories is also contemplated. There is a limited but definite scope for American makers of sugar machinery to assist in equipping the new factories. The methyl alcohol and formaldehyde situation, just as in America, is seriously affected by the new synthetic manufacture in Germany. With a little luck and in more capable hands, a British process might have been first in the field, but it is now doubtful whether its history and apparent mismanagement will be worth discussing. Some interesting advances are recorded in the production of an acid-resisting pitch concrete, and in mouldable and adherent rubber linings for vessels, resistant even to boiling hydrochloric acid. As regards fuel, interest is reviving in pure free-burning high temperature coke for domestic use as a substitute

Readers desirous of further information regarding the topics discussed can be put into direct communication with our correspondent.

both for coal and anthracite, the best results being attained by careful blending partly with coke breeze. A curious situation has arisen in the briquetting industry, manufacturers of patent fuel being reluctant to continue large scale operations in spite of the present low price of pitch. Uncertainty as to future price levels is a contributory cause and in consequence, new binders are still being sought after. Seaweed extract has been tried with success but is evidently too costly and restricted to one or two localities. A new, cheap and universal vegetable binder, commercially waterproof, is to be tried on a large scale at Swansea during the summer and the preliminary trials are said to have proved successful. The Stream-Line Filter is now making good progress in specialized industries, the paper and other difficulties having been successfully overcome. Details of its commercial application to the purification for reuse of solvents in the dry-cleaning industry are given in the Journal of the Society of Chemical Industry ("Chemistry and Industry"), of March 13, 1925. Rotary filters and filter press plates have recently been designed and operated. The possibility of making sulphate of ammonia direct from ammonia and sulphur dioxide, has always been attractive, but the difficulty of rapidly oxidizing the sulphite appeared insuperable. A small commercial unit for carrying out a process of this kind is to be started up near Middlesboro next month and if successful, may prove to be of far-reaching importance.

American plant and equipment is again being purchased, partly on its merits and partly owing to the more favorable exchange. Makers of specialized plant would do well to study the British and Continental markets, with a view to proper representation.

Precipitation of Acid Fog

The Cottrell precipitation process has been applied with some measure of success in this direction, but at the present time considerable interest is being taken in the possibilities of the Calder-Fox scrubber and several of these are now in successful operation, eliminating almost entirely the fume from sulphuric acid concentration plant and giving an exit gas containing less than one grain of SO_3 per cubic foot. In addition, the recovered acid is of higher strength than that obtainable with coke scrubbers of large size such as are usually required. The apparatus consists of a series of perforated baffles 18 or 36 in. diameter, in which the particles of mist coalesce by the scrubbing action produced, which includes the subjection of the gases to the effects of high speed and impact. The 36 in. scrubber will treat 20-60

cu.ft. of gas per second and this output is very remarkable considering the very small size of apparatus. A slightly increased draught only is required, involving an increase of speed of the acid gas fan, but it is important to keep the gases at a temperature of between 110 deg. and 120 deg. C. if best results are to be obtained.

Recent statistics, published by the Board of Trade, indicate considerable expansion in the export trade for coal tar products and also in heavy chemicals. There is also considerable activity in the publication of technical books and a tendency towards improving the standard and subdivision of subjects. Ernest Benn, Limited, is showing considerable enterprise in this direction, as exemplified by their further series of monographs on chemical engineering subjects.

Domestic Output of Graphite Lower in 1924

The graphite industry in the United States suffered a considerable setback in 1924, according to figures compiled by the Geological Survey in co-operation with the State geological surveys of Alabama and Michigan. The output in 1924 was 4,971 short tons, valued at \$87,510, as compared with 6,038 tons, valued at \$190,944 in 1923. Of this output amorphous graphite amounted to 4,071 tons, a very slight increase as compared with 1923, and crystalline graphite amounted to 900 tons, as compared with 1,982 tons in 1923, a decrease of 55 per cent. During the war, both before and during our participation in it, the graphite industry in the United States flourished and reached its highest output and value. With the cessation of hostilities the demand fell off, and the sales decreased markedly in 1919. In 1920, in line with the general prosperity, the output increased, but it fell off again and reached its lowest output and value in many years in 1921. In 1922 and 1923 the trend was upward and increases were made. The manufacture of artificial graphite at Niagara Falls, N. Y., also decreased markedly in 1924, 10,986,192 lb. being manufactured, as compared with 1923, when the output was 26,761,015 lb.

Monsanto Chemical Co. Victor in Saccharin Case

United States District Attorney Curry at St. Louis, Mo., April 20 dismissed charges of misbranding a food product against the Monsanto Chemical Co. of St. Louis, Mo. The cases had been pending in the United States courts for 5 years and at two trials the government failed to convict the defendant of the charge. The case was based upon the accusation that saccharin, a substitute for sugar, was harmful to the health of consumers. At both trials, the first in 1920 and the second in 1924, the jury failed to agree. The alleged misbranding was only incidental as had the Government been successful it would have been empowered to prohibit the use of saccharin in foods.

Conditions Favorable for Progress of French Dye Industry

Home Producers Supply More Than 75 per Cent of French Requirements—Synthetic Production of Anthraquinone Planned

From our Paris Correspondent

IN the foreground of the present situation is placed the question of Franco-German relations, and also that of the Treaty of Commerce which is far from being settled.

Meanwhile, it has been decided to apply the general schedule, and the French chemical industries, are sufficiently protected by the prolongation of the clauses of the Treaty of Versailles until Aug. 15, 1928.

The present situation is particularly favorable to the dye industry which has been considerably developed since the war. The home industry supplies more than 75 per cent of the inland requirements. The remainder is supplied about 10 per cent by Switzerland, and about 15 per cent by Germany.

However, that applies only to finished dyes and not to intermediates which, for instance, were bought in Germany by the "Compagnie Nationale des Matières Colorantes et Produits Chimiques." That company, since the amalgamation with the Etablissements Kuhlmann, cancelled the agreement previously made with the Germans for the use of some special processes.

The Cie. Nationale des Matières Colorantes et Produits Chimiques is no longer tied up commercially, but still makes use of the German processes. The Germans now refuse to supply some intermediate products, such as anthraquinone, which is produced but in very small quantities in France. The Etablissements Kuhlmann have since applied to the United States; one of their representatives having visited that country in order to buy the intermediate products. It is understood that the Etablissements Kuhlmann intend producing anthraquinone by the synthetic process in condensing phthalic anhydride with benzol, followed by cyclisation of the benzoylbenzoic acid thus obtained.

As regards the phthalic anhydride, they will likely adopt the Gibbs process: oxidation of the naphthalene vapors by means of a catalytic process. It is also reported that those people are making serious efforts to produce leather dye-stuffs such as indanthrene, algol, etc., which have not yet been produced in France. At one time, they entertained the hopes of creating new dyes derived from perylene, following discoveries of the Austrian Professor Alois Zink, but their hopes were not materialized and are not likely to come to anything definite in the near future.

The position of the two largest French dye works is pretty strong,—principally that of Société des Matières Colorantes et Produits Chimiques de Saint-Denis. The capital of that Society amounts to 30 million francs. It is said that their annual sale exceeds 80,000,000 fr.; and that their profits amounted to 6,100,163 fr. In 1924, the dividend was 40 fr. per share, or 16 per cent. They seem to be completely in-

dependent from Germany, as they can make by themselves all the materials necessary for their production of dyes—particularly acid dyes, direct and basic, with the exception of indigo and alizarine dyes.

The financial standing of Etablissements Kuhlmann is not quite so strong, although—when they absorbed the Cie. Nationale des Matières Colorantes, the Capital of this latter Society was reduced from 100 million francs to 50 million francs, which meant a substantial redemption. But, at the same time, it must be taken into account, that Cie. Nationale was only established in 1917; they had to erect their Works at high cost prices, which sometimes made their financial situation a rather difficult one.

The make of synthetic indigo by E. Bourcart, during 1919-1920, resulted in large profits for them. Their annual production then reached 700 tons, but afterwards, it decreased considerably owing to German exports. It is now estimated at about 400 tons per annum, the larger part of which is exported.

Etablissements Kuhlmann are continually seeking new processes. It is reported that they started lately to produce synthetic acetic acid in their works of Villers St. Paul. Moreover, they have established a branch Société la Philanaise, to "woollen" cotton by means of concentrated nitric acid, Schwartz process, but this process seems to meet with difficulties in its operation; besides, there are conflicting claims for priority.

Other French works are: Mabboux & Camell, Lyon; Steiner, Vernon, Laroche and Juillard, Lyon. Also in France are branches of the Swiss chemical Works, such as the St. Fons Works. All these works are of a secondary importance.

Competition for Caustic Soda Trade of East Indies

A report from Vice-Consul Denmark at Soerabaya states that there exists at the present time very marked competition between the United States and Great Britain in the matter of supplying the Netherlands East Indies with caustic soda. For years the United States was in the lead, losing the commanding position to Great Britain only during 1924.

During 1922 the United States furnished almost 50 per cent of the entire amount imported, during 1923 slightly over 50 per cent, and during the past year was forced to surrender first place to Great Britain with approximately 60 per cent of the total amount imported. During 1924 there were 3,172,474 kilos of caustic soda imported into Netherlands India of which Great Britain supplied 1,882,361 kilos and the United States 1,220,045 kilos. These figures apply only to Java and Madura and do not include the lesser amounts

French-German Producers Allocate Potash Supply

Recent reports from Paris have stated that French and German producers were holding a conference in that city. These reports have been followed by a statement that an agreement has been reached whereby distribution of potash to all countries has been allocated. Prices were fixed and shipments to the United States pro-rated last August. The present agreement practically gives to these producers, control of supplies for the entire world.

imported into the outlying possessions of Netherlands India. Of the remainder the Netherlands supplied the principal part with only very small amounts coming from Japan and Germany.

The English firm of Joseph Crosfield & Sons, Ltd., of London, soap manufacturers, are at the present time playing the leading role in the local market for caustic soda. Local importers state that England is to be reckoned as the strongest competitor of the United States in this line of chemicals but that at the present time prices are slightly better in the United States than in England. This feature, however, is counterbalanced by higher freight rates from America with the result that the trade will probably go to that country whose exporters push their business the strongest.

Calman Nominated as President of New York Paint Club

The annual meeting of the Paint, Oil and Varnish Club of New York will be held at the Hotel Biltmore, New York City, on Thursday evening, May 14. Officers will be elected for the ensuing year. The nominating committee has made the following selections: President, Henry L. Calman; vice-president, Charles J. Roh; secretary, Herbert G. Sidebottom; treasurer, William R. Morpeth. Delegates and alternates to the thirty-eight annual convention of the National Paint, Oil and Varnish Association, also will be elected at this meeting.

Union Oil Will Build Refinery at Vancouver

The Union Oil Co. of Canada, a subsidiary of the Union Oil Co. of California, has purchased from the Burnaby Municipal Council a parcel of land, approximately 43 acres in extent, facing on Burrard Inlet, on which it will build a refinery, which, it is said, will cost in the neighborhood of \$2,000,000. The company also has options on private adjoining land, which will bring the total area up to 63 acres. The Union Oil Co. has had a small refinery in operation at Port Moody, for the last two years, and part of this equipment will be used at the new plant at Burnaby, a suburb of Vancouver.

Men You Should Know About

CLIVE M. ALEXANDER, consulting engineer has opened an office at 502 Cosden Bldg., Tulsa, Okla., where he does a general consulting business on petroleum refineries and natural gasoline plants.

H. E. NEUBAUER, formerly assistant chief engineer of the Buffalo Foundry & Machine Co., later vice-president of O. S. Sleeper Co., Inc., has become associated with the Chemical & Vacuum Machinery Co., Inc., Buffalo, N. Y., as chief engineer.

DR. J. PEARCE MITCHELL, professor of chemistry and chairman of the Lower Division at Stanford University, will



Dr. J. Pearce Mitchell

succeed Dr. O. L. Elliott as Registrar of the University upon his retirement at the end of the present college year. Dr. Elliott was the first man appointed to the faculty by Dr. David Starr Jordan at the opening of Stanford in 1891 and has been Registrar since that time. As a chemist Dr. Mitchell ranks high and attracted particular public attention by his work in co-operation with other Stanford men in devising methods by which agriculture could be saved from disaster through cement dust near cement factories and through smelter fumes. Graduating from Stanford in 1903, Dr. Mitchell received his master's degree the next year and his doctorate in 1909, having in the meantime spent a year in European study. He began teaching at Stanford the year after his graduation, and with the exception of the year in Europe, has been continuously on the faculty since that time.

R. M. CONNER has been appointed director of the Gas Appliance Testing Laboratory of the American Gas Association, which is now being established in Cleveland, Ohio. Mr. Conner has been head of the laboratory of the Portland Gas & Coke Co., Portland, Oregon, and quite recently connected with gas appliance testing work for a short period in the city of Los Angeles. Mr. Conner took up his new duties the first of the present month.

H. M. JOHNQUEST, formerly chief chemist of the manufacturers division

of the Chase Co., Inc., Waterbury, Conn., has opened a consulting office at 42 Bank St., Waterbury, Conn., as chemist on general analytical work and consultant in electrodeposition finishes, making a specialty of factory problems.

M. J. GARVIN, refinery engineer and J. S. DESMOND, assistant chemical engineer of the United States Bureau of Mines, formerly headquartered at San Francisco, Calif., are now in Colorado. Mr. Garvin has been appointed engineer in charge to supervise the construction and operation of an oil shale plant for which Congress has recently passed an appropriation of \$90,000, and Mr. Desmond will be his assistant.

WALLACE W. BOONE has resigned as assistant professor of metallurgy at the University of Cincinnati. He goes to Detroit to assume the duties of metallurgist with the American Radiator Co.

E. J. FOLEY, senior executive of the Safety in Mines Research Board; Dr. R. V. Wheeler, director of the Mines Experiment Station of Great Britain, W. R. Chapman and Dr. H. F. Coward, form the British coal mines commission which is visiting the United States. These four men, representing the Safety in Mines Research Board landed in New York, April 14, prepared for a stay during which, it is hoped, a plan will be worked out by which duplication of effort in mine safety research by the U. S. Bureau of Mines and the Mines Bureau of Great Britain will be greatly reduced.

MILO R. DAUGHTERS of Haines City, Florida, is leaving the Polk Co., where he has been doing research on citrus products for the past three years, to accept the position as chief chemist and manager of chemical engineering research for the Sprague-Sells Corp., manufacturers of canning machinery in the United States. He will be located in their Hooperston plant in Illinois.

ARTHUR G. SHAW, of London, England, inventor of the Shaw gas kiln, is on a visit to the United States in connection with kiln installations at several plants in this country. He is accompanied by Mrs. Shaw.

DR. R. R. SHIVELY of Washington, Pa., for the past three years chief technologist and glass expert for B. F. Drakenfeld & Co., New York, has been elected a member of the board of directors of the company.

G. O. CARTER, consulting engineer of the Linde Air Products Co., New York, gave an instructive address at the Carnegie Institute of Technology, Pittsburgh, Pa., April 17, on the subject "The Importance to Industry of Properly Designed Chemical Equipment."

R. L. FRINK, glass expert for the British government, and well known in the industry in the United States, has returned to this country for a short visit, and will spend the majority of

his time at Lancaster, Ohio. Mr. Frink expects to return to England early in June.

GENERAL AMOS A. FRIES, the head of the Chemical Warfare Service, left Washington May 15, for an official tour of all military posts in the United States. The principal object of his trip is to bring home to other branches of the military service the important bearing which chemical warfare is likely to have on their activities in case of war. While in the South, General Fries will take advantage of the opportunity to acquaint himself first hand with certain aspects of the boll weevil situation.

ROBERT D. LANDRUM, past president of the American Ceramic Society has been appointed general manager of the Ceramic Materials Department of the Titanium Alloy Manufacturing Co. For



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R. D. Landrum

the present he will devote his major attention to the use of opax and other zirconium compounds in the enameling industry.

Obituary

A. O. BACKERT, president of the Penton Publishing Co., Cleveland, Ohio, died at his home in that city, April 24, 1925. Mr. Backert was active and prominent in the field of technical publishing having been engaged for a number of years in editorial work and serving later as president of the Associated Business Papers, Inc. He was born in Cleveland, Ohio, Feb. 3, 1876 and attended Western Reserve University. In 1899 he married Beatrice M. Fielding. He was successively associate editor of *Iron Trade Review* and the *Foundry*, western editor of *Iron Age*, editor of the *Foundry* and engineering editor of the *Iron Trade Review*, vice-president and general manager of the Penton Publishing Co., and later president. He was the author of a number of contributions to the American Foundrymen's Association, and served that organization as secretary-treasurer from 1914-1918, and as president, 1918-1919. He was later made an honorary member. He organized the Foundry Supply Mfgs.' Assn. of which he was secretary-treasurer for

several years. At the time of his death he was secretary-treasurer of the Foundry Equipment Manufacturers' Association. He was a member of the Iron and Steel Institute (London), American Iron and Steel Institute, A.I.M.E. and Cleveland Engineering Society. An associate of Mr. Backert's has made the following comment on his life: "His career was testimony of the opportunity for service open to the technical journalist. Never a producer or merchant of iron and steel products, he so saturated himself with the atmosphere of the business that for years he had been admitted to its inner circles as a valued advisor. He was not technically educated but he learned early in his editorial life the value of study of his specialty and he long since became known as an expert, not only in the business of iron and steel but also in its technology. In foundry practice especially he had for years been one of the leaders. In his later life when his administrative duties as head of a large publishing company made it impossible for him to continue close editorial contact with his field, he still retained the confidence of the industry and improved every occasion to capitalize that confidence in advice and suggestion to his editorial associates."

A. O. EIMER, secretary and treasurer of the Hevi Duty Electric Co., Milwaukee, Wis., died April 13.

JAMES F. MORSE, senior member of the firm of James F. Morse & Co., 66 Norfolk St., Roxbury, Mass., manufacturer of laundry soap, died May 1 in Hamilton, Bermuda, following an operation. Mr. Morse is survived by his wife and four children. One son, Roger E., was associated with him in the soap manufacturing business.

W. P. KAUFMAN, formerly superintendent of the Canada Starch Co., Cardinal, Ont., died in the Manhattan Square Hospital, New York City, following an operation for erysipelas and mastoid. He was born in British Guiana 42 years ago.

VISCOUNT LEVERHULME died May 7 of pneumonia. He was one of England's greatest industrial leaders, and was known as the "soap king." He was 74 years old. We quote, in part, from the *N. Y. Times* of May 7: "William Hasketh Lever found his first job cutting and wrapping soap when he was 16. From this humble beginning he became one of England's greatest industrial captains. His factories and enterprises have followed the British flag over the earth, from Port Sunlight, his model English village, to the Congo, to China, South Africa, Australia, the United States and Switzerland. Lord Leverhulme was the first great British employer to introduce profit-sharing schemes and industrial co-partnership. He favored a six-hour working day for his employees, but never worked less than sixteen hours a day himself. His system of co-partnership was started in 1901, and never has been changed. He was born in 1851, at Bolton, Lancashire, and in 1874 married Elizabeth Hulme, who died in 1913. They had one son, W. H.

Lever, who is the only heir to his father's vast fortune. Lord Leverhulme was elevated to the peerage in 1917, taking his own name combined with the maiden name of his wife."

WILLIAM SHAW GEORGE, head of the W. S. George Pottery Co., East Palestine, Ohio, died suddenly at New York, April 13, of pneumonia, aged 63 years. Mr. George was well known in the chinaware branch of the ceramic industry. He was born near East Liverpool, Ohio, in 1865, and entered the pottery business when a young man. In 1898 he took over the management of the East Palestine Pottery Co., East Palestine, Ohio, the site of which is now occupied by the No. 4 plant of the W. S. George chain of potteries.

GEORGE W. DAVISON, vice-president of the Davison Chemical Co., Baltimore, Md., died at his home in that city, April 4, after an illness of about one year. Mr. Davison was 80 years of age, and prominently identified with the chemical industry.

EDWARD G. PROULX of Lafayette, Ind., state chemist for the past seven years, died recently at a local hospital, following an illness of a number of months' duration. Mr. Proulx was 44 years of age, and a graduate of Purdue University; he was prominently identified with chemical interests in different parts of the country primarily in connection with agricultural work.

Industrial Notes

The Chicago Pneumatic Tool Co., Chicago, have entered into an agreement, whereby they will become exclusive distributors in the United States of the Pedwyn balancer. This device provides means for suspending, lifting and balancing of electric and pneumatic portable tools, increasing labor efficiency and decreasing overhead hazards. The Company will carry a stock of these balancers in its 22 branch and service stations. It is also announced that the Chicago Pneumatic Tool Co. is opening a branch office in Mexico at 1a San Juan De Letran, 15 Mexico, D.F.

The Graver Corp., East Chicago, Indiana, now have the exclusive sales and manufacturing rights for the Jenkins Cracking Process. The sales will be handled through the offices of the Graver Corp. at East Chicago, Ind., Chicago, New York, Tulsa and Houston, and the fabrication done at its plant at East Chicago, Ind. The personnel of the Jenkins Petroleum Process Co., however, remains the same with W. C. Black, T. S. Black, A. G. MacGuire and U. S. Jenkins in exclusive control of all patent rights and royalties. Their headquarters will remain at 208 So. LaSalle Street, Chicago, Ill. All inquiries regarding the Jenkins process should be taken up with the Graver Corp.

The DeLaval Steam Turbine Co., Trenton, N. J., announces that all products of the company and also the products of the DeLaval Separator Co., Poughkeepsie, N. Y., will be handled exclusively in New England by the Turbine Equipment Co. of New England, Chamber of Commerce Building, 80 Federal Street, Boston, Mass. F. R. C. Boyd, who for fifteen years has been connected with the Power Equipment Co., the former representative, is president of the new Turbine Equipment Co.

The general offices of the Mathieson Alkali Works, Inc., have been moved from 25 West 43rd Street to 250 Park Ave., New York City.

Baker-Perkins Co., Inc. (Werner & Pfeiderer Co.) announce the removal of its New York office to 250 Park Ave.

George J. Hagan, founder and formerly president of the George J. Hagan Co., has disposed of his entire interest in that company and has opened offices in the Peoples Bank Bldg., Pittsburgh, Pa. He will devote his entire attention to the design and construction of industrial furnaces, which has been his specialty for the past twenty-eight years.

The duPont Fibersilk Co., with plants at Buffalo, New York and Old Hickory, Tenn., has changed its name to the duPont Rayon Co. This is to conform with its recent adoption of the name "Rayon" for its product, which heretofore has been known as artificial silk.

The Technical Service Co., industrial consultants and factory specialists, has moved to larger quarters in the Woolworth Building, New York City.

Calendar

AMERICAN ASSOCIATION OF CEREAL CHEMISTS, annual meeting, St. Louis, Mo., June 1 to 5.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (Northern New England and Rhode Island Sections), Providence, R. I., June 24.

AMERICAN CERAMIC SOCIETY, starting at Rochester, N. Y., then on to Montreal, Quebec, back to Toronto and Niagara Falls or Hamilton, July 4 to 11.

AMERICAN ELECTROCHEMICAL SOCIETY, Chattanooga, Tenn., Sept. 24, 25 and 26.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, semi-annual meeting, Providence-Biltmore Hotel, Providence, R. I., June 22 to 25.

AMERICAN LEATHER CHEMISTS' ASSOCIATION, 22nd annual convention, Atlantic City, N. J., June 3, 4 and 5.

AMERICAN PULP AND PAPER MILL SUPERINTENDENTS ASSOCIATION, Niagara Falls, N. Y., June 4 to 6.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, June 22 to 26.

CHEMICAL EQUIPMENT EXPOSITION, Association of Chemical Equipment Manufacturers, State Armory, Providence, R. I., June 22 to 27.

COLLOID SYMPOSIUM (Third National) University of Minnesota, Minneapolis, Minn., June 17 to 19.

CONGRESS OF INDUSTRIAL CHEMISTRY (Fifth) Paris, France, Sept. 27, 1925.

NATIONAL ASSOCIATION OF PURCHASING AGENT, Milwaukee, Wis., May 25 to 28.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, New York, Sept. 28 to Oct. 3.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING (Fourth), Grand Central Palace, N. Y., Nov. 30 to Dec. 5.

NATIONAL FOREIGN TRADE COUNCIL, Seattle, Wash., June 24 to 26.

NATIONAL LIME ASSOCIATION, 7th annual convention and 23rd annual meeting, Briarcliff Lodge, Briarcliff Manor, Westchester County, N. Y., May 26 to 29.

Market Conditions and Price Trends

Prices for Chemicals Show Tendency To Stabilize

Slight Decline in Weighted Index Number Caused By Fluctuations in Miscellaneous Items With Basic Chemicals Steady

WHILE the downward movement of prices for chemicals has not been entirely checked, changes during the past month were within narrow scope. The majority of selections maintained a steady price position and the stability to values, which, in turn, means an absence of selling pressure, indicates a close conformity of production and consumption.

Generally speaking, production of chemicals so far this year has outstripped that for the corresponding period of 1924. Contract commitments, at the beginning of the year exceeded those for the preceding year. Buying for new account has not been heavy but is regarded as fully up to the standards set last year, thus rounding out a total tonnage movement, larger than a year ago. In some cases domestic production has been aided by lessened competition from foreign markets. Higher import duties have cut down the inward movement of oxalic acid and nitrite of soda. This has created an enlarged demand for domestic goods and has stimulated the home outputs. A similar situation has been created in the case of chlorate of potash and manufacture in this country promises to be on a larger scale over the remainder of the year. Recent advances in costs abroad also have given an advantage to domestic producers of citric and tartaric acids.

Position of Consumers

The relative position of some of the more important consuming industries may be inferred from a comparison of employment figures. The most recent figures which carry an official stamp, are those compiled by the Bureau of Labor. These figures are reduced to index numbers on a basis of 100 as the monthly average for 1923. They offer the following comparisons:

INDEX OF EMPLOYMENT

	March 1925	March 1924	Feb. 1925
Dyeing and finishing			
Textiles	102.8	94.8	101.8
Leather	92.6	94.3	92.7
Paper and pulp	96.6	96.8	94.2
Chemicals	93.5	98.4	92.5
Fertilizers	137.4	98	137.9
Glass	92.7	99.9	91.1
Automobile tires	107.9	95.5	106.1
Petroleum refining	89.4	93.1	89.6

An analysis of these figures emphasizes the expansion over last year, in such large consuming trades or dyeing and finishing textiles, fertilizer, and automobile tires. The leather, paper and pulp, and petroleum refining in-

dustries are very little behind the totals of last year. In the strictly chemical industry a good part of the loss as compared with a year ago, undoubtedly can be traced to the marked decline in production of arsenic, calcium arsenate, and wood distillation chemicals.

Production of arsenic and calcium arsenate could not fail to be affected by the unusually heavy carryover of stocks from the previous season. The outlet for arsenate has not been broad enough to relieve the situation and the probabilities are against late season buying bringing about any material improvement. The fact that imported arsenic has been underselling domestic, likewise militates against any increase in domestic production and is a practical guarantee against an increase in price.

Methanol and Alcohol Lower

The weighted index number for chemicals now stands at 112.24 as compared with 112.60 a month ago and 113.60 in May, 1924. Methanol and alcohol were the chief contributors in bringing about the lower average. The position of wood distillation chemicals and alcohol is still too unsettled to make further price declines improbable but with these and a few minor exceptions, steady prices are expected to rule for the near future.

Values for oils and fats have fluctuated more widely than those for chemicals and the trend has been downward. The weighted index is 153.13 which compares with 154.01 a month ago and 125.88 in May, 1924. Reduced to an actual trading basis, prices have been more in buyers favor than is indicated by the fall in the index num-

ber. This is explained by the fact that crude cottonseed oil is used in determining the weighted number and refined oil has declined to a greater degree than the crude product. China wood oil also sold at considerably lower levels for the greater part of the period than was quoted at the close. Prospects still favor lower prices for some of the more important commodities of the oil and fat groups.

Exports of Chemicals Increase

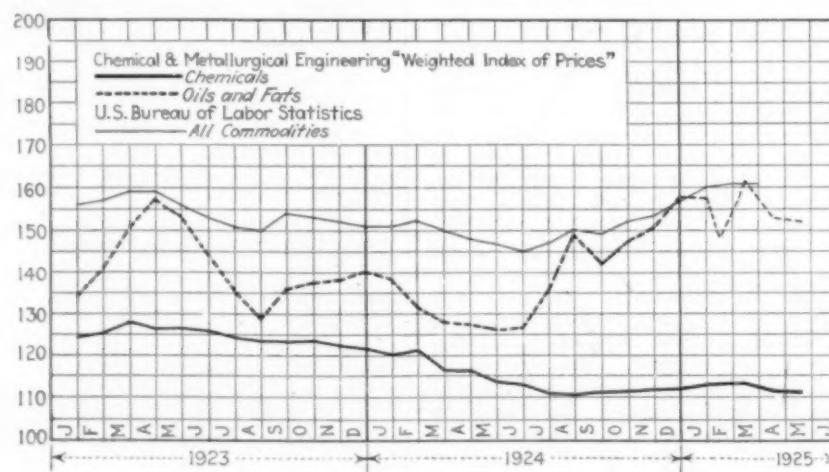
The exports of chemicals and allied products from the United States during the first quarter of 1925 attained an aggregate value of \$36,034,000 and showed an 11 per cent increase over the corresponding period of 1924. This figure was higher than that for any single quarter throughout the year 1924.

The greater part of this increase was taken up by shipments of allied products. For instance naval stores recorded an advance of 43 per cent with paints, varnishes, and explosives also showing good gains.

Exports for the quarter as referred solely to industrial chemicals, reveal only a slight change over the corresponding period of 1924, the increase in valuation being about 1 per cent. Larger amounts of acids and anhydrides, aluminum sulphate, acetate of lime, bleaching powder, copper sulphate, dextrine, and formaldehyde, were sent abroad during the present quarter than during the first quarter of 1924.

Sulphur improved 33 per cent in quantity and 50 per cent in value from 93,400 tons, valued at \$1,443,000 to 125,000 tons, valued at \$2,165,000. France, Germany, Australia, Spain, and the United Kingdom were the leading consumers in the order named.

Although the quantity of fertilizers exported in January-March, 1925, was very slightly under the figure for the corresponding period in 1924, the value was 5 per cent less.



Market Conditions and Price Trends

Facts and Figures of Business in Chemical Engineering Industries

PRODUCTION in manufacturing industries in March increased 2 per cent over February when allowance is made for the longer number of working days, according to the index number of the Department of Commerce, and was 2 per cent higher than in March, 1924. The principal increases over February occurred in the output of automobiles, with a gain of more than 32 per cent,

Industrial Statistics Presented Graphically for Those Who Follow the Monthly Trends of Production and Consumption

and in stone and clay products with 25 per cent, while slight increases were shown, when reduced to an average daily basis, in the output of iron and steel, paper, lumber, and leather. Increases over a year ago were made in all groups except foodstuffs, textiles, chemicals and oils, and non-ferrous metals.

The output of raw materials was 3 per cent greater in March than a year ago, the marketings of animal products increasing 4 per cent over a year ago, as computed by the Department of Commerce index numbers, while crop marketings increased 6 per cent, forestry products increased 9 per cent and mineral production declined 3 per cent during the month.

The index of unfilled orders declined during March and was 5 per cent lower than a year ago, iron-and-steel unfilled orders being the same on March 31 as a year ago while orders for building materials declined.

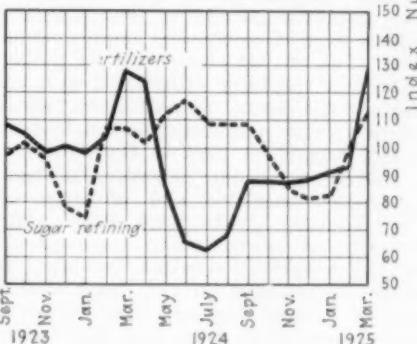
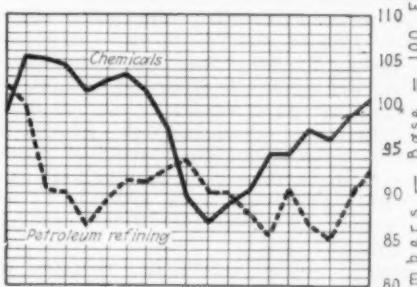
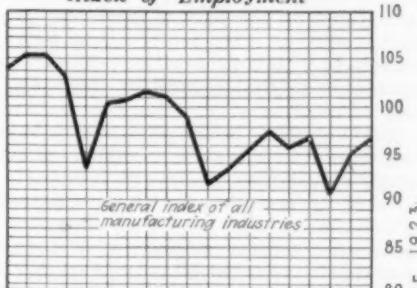
Stocks of commodities held at the end of March increased one per cent during the month, when allowance is made for seasonal tendencies, and 9 per cent over a year ago. Stocks in each group, however, except raw foodstuffs declined during March, when seasonal factors are eliminated, while compared with a year ago, all groups showed increased stocks on hand.

While wholesale prices of many commodities averaged lower in March than in February, the general level was slightly higher, according to information gathered in representative markets by the United States Department of

Labor through the Bureau of Labor Statistics. The Bureau's weighted index number, which indicates 404 commodities or price series, registered 161.0 for March compared with 160.6 for the preceding month.

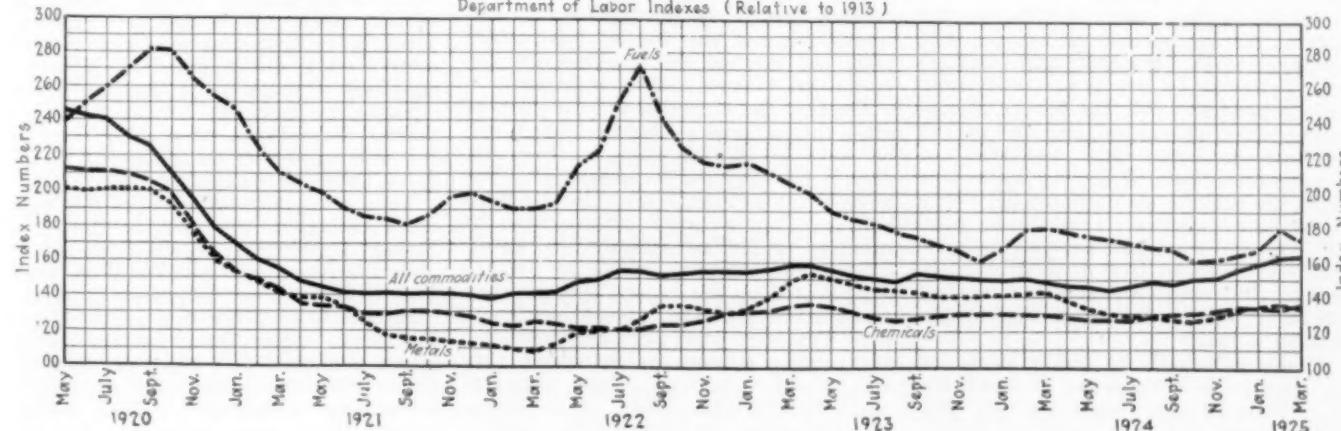
Prices for foodstuffs increased, but other group prices averaged lower than in February, ranging from less than one-fourth of 1 per cent in the case of farm products, clothing materials, and chemicals and drugs, to 1½ per cent in the case of fuels and building materials. Metals and housefurnishing goods were about 1½ per cent cheaper than in February.

Index of Employment



Wholesale Prices

Department of Labor Indexes (Relative to 1913)



Market Conditions and Price Trends

Increased Outlet for Bromine Placed in Doubtful Position

Discontinuance of Sale of Ethyl Gasoline May Check Domestic Production—Importations of Synthetic Methanol Increase and Weaken Market Values

FOLLOWING the optimistic reports of last month which predicated a greatly increased demand for bromine, came the recent announcement that the sale of gasoline into which bromine entered, had been discontinued. This has caused uncertainty about future operations on the part of domestic producers and, at least for the time being, makes less favorable the outlook for expansion in that branch of the chemical industry.

Developments in the past month have not served to reassure members of the wood distillation industry. Importations of synthetic methanol have gained in volume and the fact that some consumers have covered their needs in foreign markets, automatically takes them out of the market for the home-made product. Prices for the latter have been revised sharply downward but it is generally conceded that competition with the synthetic material cannot be carried on successfully.

Important changes are gradually taking place in the status of some domestic chemicals as a result of decreased offerings from abroad. This is especially noticeable in the case of nitrite of soda. Greater protection through import tariffs has resulted in steady operations at domestic plants and domestic nitrite is now filling a larger part of consuming requirements. The home output of chlorate of potash has been similarly stimulated and for the same reason. Imports are falling off in volume and are expected to play a less important part in the future.

Bleaching powder, however, has been somewhat unsettled and offerings of foreign-made goods have been more frequent at prices under those quoted by the lowest of domestic sellers. It is also noted that arrivals from abroad are of larger tonnage and there is some speculation regarding the future effect of such offerings.

Attention has been drawn to the arsenic market because of reports that surplus stocks have not been worked off. Prices are about 50 per cent lower than a year ago but this has no stimulating effect on consumption and sellers of both imported and domestic are hoping for a belated buying movement from the calcium arsenate trade. There is nothing tangible in which to base an opinion that consumption will or will not increase but it is practically certain that sales of arsenic will fall far short of the totals reached in the last crop-year.

Trade in alkalis is going along on an even basis with every prospect for a continuance of a steady market. Export demand has been good and quota-

tions on an f.a.s. basis have been firm enough to indicate that producers are not carrying large surplus stocks.

Complications in Bromine

Recent developments have tended to cause doubts about the continuance of production of bromine on the extended scale which had been put into operation. Producers had been influenced to

Important Developments in the Market

French-German producers complete plans for allocation of potash supplies to all consuming countries.

Bromine situation is complicated by cessation of sale of anti-knock gasoline.

Domestic production of arsenic is held in check by large surplus stocks and by narrow outlet for calcium arsenate.

Over-supply of China wood oil in spot market caused sharp break in prices and restricted buying of futures.

Larger importations of synthetic methanol emphasize the growing competition from abroad and bring out lower selling prices for the domestic product.

make every effort to increase the supply because of the prospective outlet offered by its use in the manufacture of anti-knock gasoline. In addition to increasing operations at existing producing points, plans had been perfected and put into effect for extracting bromine from salt water. Because of controversies which have arisen regarding the lethal effects of anti-knock gasoline produced through the aid of tetra-ethyl-lead, producers of this gasoline have discontinued its sale temporarily. If this action becomes final or if production of anti-knock gasoline is continued without the use of tetra-ethyl-lead, the market for bromine will revert to its former restricted fields.

Possibly the situation will be clarified after the national conference which will be held at Washington on May 20. Should the decision be unfavorable for tetra-ethyl-lead gasoline, the promise held out for a large consumption of bromine would necessarily go unfulfilled. The situation would be further complicated by the report that gasoline manufacturers have placed contracts with domestic and German producers of bromine, calling for deliveries over an extended period. The contracts could hardly be voided on a force-majeure clause and should the sellers

enforce deliveries, these supplies undoubtedly would find their way into the resale market with the effect of disrupting values and of slowing up even normal domestic production.

Lower Price for Methanol

The importance of German synthetic methanol in our markets is demonstrated by import statistics just issued by the Department of Commerce. Imports of this material in 1924 were 48 gal. Imports for the first quarter of 1925 were as follows:

	Gal.	Value
January	40	\$26
February	63,971	29,420
March	69,886	26,976

The invoice price for March arrivals, averages about 38½c. per gal. which, with the addition of 12c. per gal. duty, would make a total landed cost of 50½c. per gal. While this figure is considerably below the asking price of sellers of domestic methanol, it could be reduced materially if reports are true that manufacturing costs in Germany are as low as 18c. per gal. Under the influence of the imported product, domestic markets have been weak and an open price decline of 10c. per gal. was announced early in May.

Various reports have been heard about different companies planning to take up manufacture of synthetic methanol in this country. In the meantime the greater part of imported methanol is passing direct to consumers with no real surplus for new accounts. The position of domestic methanol made from wood distillation shows no signs of improvement and the future market seems to rest entirely with developments connected with the synthetic product.

Bichromate of Soda Trend

The majority of large consumers of bichromate of soda are covered ahead on contract. These contracts involve a large tonnage and insure a fairly large production for the current year. While the number of producing companies has decreased in recent years, capacity of plants now operating is in excess of consuming requirements. Hence the volume of new business is important, inasmuch as it may admit of a larger output without piling up surplus stocks. It is also noted that in years when consumption was largest even though accompanied by a corresponding increase in production, prices showed the greatest tendency to advance. It follows, then, that buying for new account is an important factor in establishing values.

Taking the first 4 months of this year as a criterion, the outlook favors a larger consumption of bichromate of soda this year than was found in 1924. This is based not only on the report that distribution for this year to date has been larger than for the corresponding period of last year, but also because of the more stabilized position of consuming industries. For several months last year, numerous tanning

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	112.24
Last month	112.60
May, 1924	113.60
May, 1923	126.76

Lower prices for methanol and the easier position of alcohol had a weakening influence on the weighted index number. Imported arsenic also sold at concessions and the same was true of sulphate of ammonia. The alkali group was on a steady level.

plants were closed and curtailed operations in the textile industry brought consumption of bichromate to subnormal levels, with buyers, in some instances, offering contract material in the resale market. It is unlikely that such a depression will occur again this year and demand for bichromate from June to October should register substantial gains over the totals reached during those months last year.

Starting in January, the Department of Commerce included bichromate of soda among the chemicals on which monthly export statistics are issued. Exports for the first quarter of the year were as follows:

	Lb.	Value
January	162,391	\$10,474
February	758,537	45,492
March	940,982	56,754

These figures show that export demand has been growing and in the total for February, for which month statistics are available for distribution according to countries, it is noted that France was the largest buyer, with the Netherlands, Canada, United Kingdom, Germany, British India, and Denmark following in the order named. Current prices for bichromate in British markets are around 8c. per lb. which is favorable for a continuance of exports from this country.

Chief interest in values for bichromate centers in the new contract prices which will be named in the summer or early fall. Contract prices for 1924 delivery were on a basis of 7½@7½c. per lb. The first prices quoted for 1925 contracts were 6½@6½c. per lb. Later on sellers offered at 6@6½c. per lb. This placed the contract level lower than for some of the pre-war years and some producers admitted that prices were too low to admit of any margin of profit. The low prices were established, following a protracted dull period in the bichromate trade and at a time when competition among producers was unusually keen.

The main factors entering into the cost of producing bichromate of soda, include labor, fuel, chrome ore, soda ash, and sulphuric acid. None of these has changed its position to a degree sufficient to warrant any material change in the cost of the manufactured product. It is true that sulphuric acid has sold recently at private terms un-

der the openly quoted price levels but the market has not been so weak as it was in the summer months of 1924 when surplus holdings were larger than they are now. In other words, there is very little reason to believe that production costs for bichromate of soda will be reduced. The new contract prices, therefore, should bear a close relationship to spot values which prevail at the time they are issued. As costs for raw materials seem to be established on fairly steady levels, values for spot bichromate should be influenced largely by the volume of new business and, as no boom period is anticipated, the forthcoming contract prices may be expected to settle around 6½c. per lb.

Poor Outlook for Arsenic

As the season advances with but limited call for calcium arsenate, the outlook for arsenic becomes more and more unfavorable. Consumption appears to have fallen back to the standards which prevailed prior to 1923 when the use of calcium arsenate as a poison for the boll weevil brought about rapid expansion in production and consumption of arsenic and arsenate. The domestic output of arsenic in 1924 was the largest on record, reaching a total in excess of 20,000 tons. Of this more than 5,000 tons was carried over by producers and insecticide manufacturers held large supplies either in the form of arsenic or of calcium arsenate.

Domestic production of arsenic in January was 978 tons. Since then no figures of production have been issued but private estimates place the current output as less than one-half that of the corresponding period last year. Imports, however, have held up well in the face of slow demand, with official returns showing the following:

	Imports of Arsenic	1925	1924
Jan. lb.	2,165,633	1,925,486	
Feb. lb.	1,589,132	1,545,024	
March, lb.	1,749,621	2,181,900	
Totals	5,504,386	5,652,410	

Some manufacturers have shipped large amounts of calcium arsenate to the cotton-growing states so as to take advantage of any spot demand which may arise as a result of future weevil infestation. Taking into consideration that these stocks, as well as those carried at producing points, must be absorbed before there will be need for fresh supplies, it is difficult to find anything of encouragement in the arsenate situation.

China Wood Oil Irregular

Shipments of China wood oil from primary points, in the last quarter of 1924 were heavy and they were followed by large quantities in the first

	Shipped from China	Arrived in U. S.	1925	1924
Jan. lb.	6,925,717	9,079,825	6,931,462	
Feb. lb.	5,768,302	9,329,769	5,835,443	
March, lb.	2,217,000	12,067,968	6,749,021	

Totals 14,911,019 30,477,562 19,515,929 quarter of this year. Shipments for China to this country, for the quarter

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	153.13
Last month	154.01
May, 1924	125.88
May, 1923	153.39

Values for refined cottonseed oil were lower but crude closed nominally unchanged. Lower selling schedules were in effect for linseed oil, coconut oil, corn oil, oleo oil, and tallow and the weighted index moved downward accordingly.

and arrivals at United States ports are shown in table.

As a result of the heavy arrivals, the spot market was over-supplied and sales were put through at prices which represented losses to importers. The situation was improved as the spot supply decreased and the amount afloat also was cut down as a result of smaller shipments from China during March and April. Sales of wood oil in bbl. on spot were made as low as 11½c. per lb. but at the close asking prices had recovered to the 13c. per lb. level although this figure might be shaded on firm bids.

The experience of traders, however, proved the danger of unrestricted shipments and as importations for the next few months promise to be of smaller volume, values are expected to hold a more stable course.

Export of Chemicals

	March, 1925	March, 1924
Benzol, lb.	2,879,140	6,538,661
Aniline oil and salts, lb.	25,608	17,578
Acid, acetic, lb.	41,490	29,812
Acid, boric, lb.	93,443	74,315
Acid, sulphuric, lb.	712,571	603,817
Methanol, gal.	63,343	26,231
Aluminum Sulphate, lb.	3,476,967	3,345,755
Acetate of Lime, lb.	1,097,939	1,622,341
Calcium carbide, lb.	474,643	1,181,891
Bleaching powder, lb.	2,084,545	3,318,383
Copper sulphate, lb.	735,022	121,235
Formaldehyde, lb.	280,817	199,654
Potash, bichromate, lb.	70,853	87,035
Sodium, bichromate, lb.	940,982	
Sodium, cyanide, lb.	46,478	307,485
Borax, lb.	2,559,276	2,823,122
Soda ash, lb.	4,911,178	2,076,300
Sodium, silicate, lb.	3,093,435	1,984,101
Sal soda, lb.	1,079,915	748,174
Caustic soda, lb.	8,604,308	5,997,383
Sulphate of ammonia, ton...	8,399	11,341

Imports of Chemicals

	March, 1925	March, 1924
Dead or creosote oil, gal.	11,155,805	2,028,841
Naphthalene, lb.	27,477	1,084,008
Pyridine, lb.	1,749,621	2,181,900
Arsenic, lb.	78,400	70,228
Acid, citric, lb.	157,125	156,432
Acid, formic, lb.	103,392	241,857
Acid, oxalic, lb.	2,383,430	2,566,760
Acid, sulphuric, lb.	441,840	303,418
Acid, tartaric, lb.	1,559,509	538,681
Ammonia, chloride, lb.	615,791	113,567
Ammonia, nitrate, lb.	2,376,220	855,491
Barium compounds, lb.	877,050	1,081,429
Calcium carbide, lb.	22,535	1,087,096
Copper sulphate, lb.	289,851	128,100
Bleaching powder, lb.	54,307	470
Potassium, cyanide, lb.	887,686	294,562
Potassium, hydroxide, lb.	977,813	1,113,035
Potassium, chlorate, lb.	1,709,388	610,621
Sodium, cyanide, lb.	3,950,300	4,141,420
Sodium, ferrocyanide, lb.	178,650	420,320
Sodium, nitrite, lb.	369,544	758,433
Sodium, nitrate, ton...	197,359	115,919
Sulphate of ammonia, ton...	5,382	1,420

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. producing points, the quotations are given on that basis and are so designated. Prices for the corresponding period last month and last year are included for comparative purposes. Prices are corrected to May 11.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums.....lb.	\$0.10 - \$0.11	\$0.10 - \$0.11	\$0.15 - \$0.16
Acid, acetic, 28% bbl.....ewt.	3.12 - 3.37	3.12 - 3.37	3.12 - 3.37
Boric, bbl.....lb.	.09 - .11	.09 - .10	.10 - .10
Citric, kegs.....lb.	.45 - .47	.46 - .47	.45 - .47
Lactic, 44% tech., light, bbl,lb.	.13 - .13	.13 - .14	.12 - .13
22% tech., light, bbl.....lb.	.06 - .07	.06 - .07	.06 - .06
Muriatic, 18% tanks.....ewt.	.80 - .85	.80 - .85	.80 - .85
Nitric, 36% carboys.....ewt.	.04 - .04	.04 - .04	.04 - .04
Oxalic, crystals, bbl.....lb.	.10 - .11	.10 - .11	.10 - .10
Sulphuric, 60% tanks.....ton	8.50 - 9.50	8.50 - 9.50	9.00 - 10.00
Tartaric, powd., bbl.....lb.	.29 - .30	.28 - .29	.27 - .30
Alcohol ethyl, 190 p.f. U.S.P., bbl.....gal.	4.90 -	4.90 -	4.81 -
Alcohol, denatured, 190 proof			
No. 1 special dr.....gal.	.60 -	.60 -	.51 -
No. 3, 188 proof, dr.....gal.	.59 -	.59 -	.50 -
Alum, ammonia, lump, bbl.....lb.	.03 - .04	.03 - .04	.03 - .04
Potash, lump, bbl.....lb.	.02 - .03	.02 - .03	.02 - .03
Aluminum sulphate, com., bags.....ewt.	1.40 - 1.45	1.40 - 1.45	1.35 - 1.40
Aqua ammonia, 26% drums, bbl.....lb.	.06 - .06	.06 - .06	.06 - .06
Ammonia, anhydrous, cyl., lb.	.30 - .32	.30 - .32	.28 - .30
Ammonium carbonate, powd., tech., casks.....lb.	.07 - .08	.07 - .08	.12 - .13
Ammonium nitrate, tech., casks.....lb.			
Ammonium sulphate, wks.....ewt.	2.75 - 2.85	2.75 - 2.85	2.60 - 2.65
Amylacetate tech., drums, gal.....lb.	2.75 - 3.25	3.25 - 3.50	3.25 - 3.75
Arsenic, white, powd., bbl.....lb.	.05 - .05	.05 - .05	.09 - .10
Arsenic, red, powd., kegs.....lb.	.13 - .13	.13 - .13	.15 - .15
Barium carbonate, bbl.....ton	51.00 - 56.00	52.00 - 58.00	64.00 - 68.00
Barium chloride, bbl.....ton	65.00 - 70.00	62.00 - 70.00	88.00 - 90.00
Barium, nitrate, casks.....lb.	.08 - .08	.07 - .08	.08 - .08
Bleaching powder, f.o.b. wks., drums.....ewt.	1.80 - 2.00	2.00 - 2.10	1.75 -
Borax, bbl.....lb.	.05 - .05	.05 - .05	.05 - .05
Calcium acetate, bags.....ewt.	3.00 - 3.05	3.00 - 3.05	3.00 - 3.05
Calcium arsenate, dr.....lb.	.06 - .08	.06 - .08	.11 - .11
Calcium carbide drums, bbl.....lb.	.04 - .04	.04 - .04	.05 - .05
Calcium chloride, fused, dr., wks., ton	21.00 -	21.00 -	21.00 -
Carbon bisulphide, drums, lb.	.06 - .06	.06 - .06	.06 - .06
Carbon tetrachloride drums, lb.	.07 - .07	.07 - .07	.07 - .08
Chlorine, liquid, tanks, wks, lb.	.04 -	.04 -	.04 -
Copperas, bbl, f.o.b. wks., ton	13.00 - 14.00	15.00 - 16.00	16.00 - 18.00
Copper carbonate, bbl.....lb.	.16 - .17	.16 - .17	.16 - .17
Copper sulphate, bbl.....ewt.	4.65 - 4.85	4.65 - 4.85	4.50 - 4.85
Cream of tartar, bbl.....lb.	.21 - .22	.22 - .23	.20 - .21
Epsom salt, dom., tech., bbl,ewt.	1.75 - 2.00	1.75 - 2.00	1.75 - 2.00
Epsom salt, imp., tech., bags,ewt.	1.25 - 1.30	1.25 - 1.30	1.10 - 1.15
Ethyl acetate, 85% drums, gal.....lb.	.90 - .92	.87 - .90	.95 - .98
Formaldehyde, 40% bbl.....lb.	.09 - .09	.09 - .09	.10 - .10
Fusel oil, crude, drums.....gal.	2.70 - 3.00	2.70 - 3.00	2.50 - 2.75
Glaubers salt, bags.....ewt.	.75 - 1.40	.75 - 1.40	1.00 - 1.40
Glycerine, c.p., drums, extra, lb.	.18 - .19	.18 - .18	.16 - .17
Lead:			
White, basic carbonate, dry, casks.....lb.	.10 -	.11 -	.10 -
White, basic sulphate, csk, lb.	.10 -	.11 -	.09 -
Lead acetate, white, crys., bbl,lb.	.15 - .16	.15 - .16	.14 -
Lead arsenate, powd., bbl.....lb.	.13 - .14	.13 - .14	.18 -
Lithopone, bags.....lb.	.06 - .06	.06 - .06	.06 - .06
Magnesia carb., tech., bags,lb.	.06 - .07	.05 - .07	.08 - .08
Methanol, 95% dr.....gal.	.65 - .68	.68 - .70	.80 - .82
Methanol, 97% dr.....gal.	.67 - .69	.70 - .72	.82 - .84
Nickel salt, double, bbl.....lb.	.09 - .10	.09 - .10	.09 - .10
Nickel salts, single, bbl.....lb.	.10 - .11	.10 - .11	.10 - .11
Phosphorus, red, cases.....lb.	.68 - 1.00	.68 - 1.00	.70 - .75
Phosphorus, yellow, cases.....lb.	.32 - .35	.32 - .35	.35 - .40
Potassium bichromate, casks,lb.	.08 - .08	.08 - .08	.09 - .09
Potassium carbonate, 80-85% calcined, casks.....lb.	.05 - .06	.06 - .06	.05 - .06
Potassium chlorate, powd., lb.	.08 - .09	.07 - .08	.07 - .08
Potassium hydroxide (caustic potash) drums.....lb.	.07 - .07	.07 - .07	.06 - .06
Potassium muriate, 80% bas ton	34.55 -	34.55 -	34.55 -
Potassium nitrate, bbl.....lb.	.06 - .07	.06 - .07	.07 - .09
Potassium permanganate, drums.....lb.	.15 - .15	.14 - .15	.14 - .14
Potassium prussiate, yellow, casks.....lb.	.18 - .19	.18 - .18	.18 - .19
Sal ammoniac, white, casks.....lb.	.05 - .07	.05 - .07	.06 - .08
Salsoda, bbl.....ewt.	1.20 - 1.40	1.20 - 1.40	1.20 - 1.40
Soda ash, light, 58% bags, contract.....ewt.	1.25 -	1.25 -	1.25 -
Soda, caustic, 76% solid, drums, contract.....ewt.	3.10 -	3.10 -	3.10 -
Sodium acetate, works, bbl,lb.	.05 - .06	.05 - .05	.05 - .05
Sodium bichromate, casks.....lb.	.06 - .06	.06 - .06	.07 - .07
Sodium chlorate, kegs.....lb.	.06 - .07	.06 - .06	.06 - .07
Sodium cyanide, cases, dom,lb.	.18 - .22	.18 - .22	.19 - .22
Sodium fluoride, bbl.....lb.	.09 - .09	.09 - .09	.08 - .10
Sodium nitrate, bags.....ewt.	2.65 - 2.67	2.65 - 2.67	2.50 -
Sodium nitrate, casks.....lb.	.09 - .09	.09 - .09	.08 - .08
Sodium phosphate, dibasic, bbl.....lb.	.03 - .03	.03 - .03	.03 - .03

	Current Price	Last Month	Last Year
Sodium prussiate, yel. drums,lb.	\$0.09 - \$0.10	\$0.09 - \$0.10	\$0.10 - \$0.11
Sodium silicate (30% drums),cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sodium sulphide, fused, 60-62% drums.....lb.	.02 - .03	.02 - .03	.03 - .03
Sodium sulphite, crys., bbl.....lb.	.03 - .03	.03 - .03	.03 - .03
Sulphur, crude at mine, bulk,ton	14.00 - 16.00	14.00 - 16.00	16.00 - 18.00
Sulphur, flour, bag.....ewt.	2.35 - 3.00	2.35 - 3.00	2.25 - 2.35
Tin bichloride, bbl.....lb.	.15 -	.14 -	.13 -
Tin oxide, bbl.....lb.	.57 -	.59 -	.55 -
Tin crystals, bbl.....lb.	.38 -	.37 -	.35 -
Zinc chloride, gran., bbl.....lb.	.07 -	.08 -	.05 - .06
Zinc oxide, lead free, bag.....lb.	.07 -	.07 -	.07 -
5% lead sulphate, bags.....lb.	.06 -	.06 -	.07 -
Zinc sulphate, bbl.....ewt.	3.00 - 3.50	3.00 - 3.50	3.00 - 3.25

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.....lb.	\$0.16 - \$0.16	\$0.16 - \$0.16	\$0.15 - .15
Chinawood oil, bbl.....lb.	.12 - .13	.13 - .13	.14 - .15
Coconut oil, Ceylon, tanks, N. Y.lb.	.09 -	.09 -	.08 -
Corn oil, crude, tanks, (f.o.b. mill)lb.	.10 -	.10 -	.08 -
Cottonseed oil, crude (f.o.b. mill), tanks.....lb.	.09 -	.09 -	.08 -
Linseed oil, raw, ear lots, bbl,gal.	1.03 -	1.06 -	.94 -
Palm, Lagos, casks.....lb.	.09 -	.09 -	.07 - .07
Niger, casks.....lb.	.08 -	.08 -	.06 -
Peanut oil, crude, tanks (mill) lb.	.10 -	.11 -	.11 -
Rapeseed oil, refined, bbl.....gal.	.98 -	.99 -	.88 - .90
Sesame, bbl.....lb.	.15 -	.15 -	.11 - .11
Soya bean tank (f.o.b. Coast) lb.	.10 -	.10 -	.09 - .10
Sulphur (olive fruits), bbl.....lb.	.09 -	.09 -	.09 - .09
Cod, Newfoundland, bbl, gal.....lb.	.62 -	.63 -	.62 - .65
Menhaden, light pressed, bbl, gal.....lb.	.72 -	.75 -	.60 -
Crude, tanks (f.o.b. factory) gal.....lb.	.55 -	.55 -	.50 -
Grease, yellow, loose.....lb.	.08 -	.09 -	.06 - .07
Oleo stearine.....lb.	.11 -	.11 -	.11 - .11
Red oil, distilled, d.p. bbl.....lb.	.11 -	.11 -	.08 - .09
Tallow, extra, loose.....lb.	.09 -	.09 -	.07 -

Coal-Tar Products

	Current Price	Last Month	Last Year
Aniline oil, drums, extra.....lb.	\$0.16 - \$0.16	\$0.16 - \$0.16	\$0.16 - \$0.16
Aniline salts, bbl.....lb.	.20 - .22	.20 - .22	.22 - .23
Anthracene, 80% drums.....lb.	.65 - .70	.65 - .70	.75 - .80
Benzol, 90% tanks, works.....gal.	.22 -	.22 -	.23 -
Beta-naphthol, tech., drums, lb.	.24 - .25	.24 - .25	.24 - .25
Cresylic acid, 97% drums, works.....gal.	.59 - .62	.59 - .62	.65 - .70
Naphthalene, flake, bbl.....lb.	.05 - .05	.05 - .05	.06 - .06
Phenol, U.S.P., drums.....lb.	.23 - .25	.23 - .25	.26 - .29
Picric acid, bbl.....lb.	.25 - .26	.25 - .26	.20 - .22
Resorcinol, tech., kegs.....lb.	1.35 - 1.40	1.30 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl.....lb.	.33 - .34	.33 - .34	.32 - .33
Solvent naphtha, w.w., tanks gal.	.25 -	.25 -	.25 -
Toluene, tanks, works.....gal.	.26 -	.26 -	.26 -
Xylene, com., tanks.....gal.	.25 - .26	.25 - .26	.28 -

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grl., white, bbl.....ton	\$17.00 - \$17.50	\$17.00 - \$17.50	\$16.00 - \$17.00
Casein, tech., bbl.....lb.	.12 - .13	.13 - .14	.11 - .12
China clay, powd., f.o.b. Ga.ton	12.00 - 15.00	12.00 - 15.00	14.00 - 20.00
Imported, pwdr., ton	45.00 - 50.00	45.00 - 50.00	45.00 - 50.00
Dry colors:			
Carbon gas, black (f.o.b. works)lb.	.07 - .07	.06 - .08	.09 - .11
Lamp black, bbl.....lb.	.12 - .40	.12 - .40	.12 - .40
Prussian blue, bbl.....lb.	.35 - .37	.35 - .37	.38 - .42
Ultramarine blue, bbl.....lb.	.08 - .08	.08 - .08	.08 - .08
Siena, Italian, bbl.....lb.	.04 - .12	.04 - .12	.06 - .14
Umber, Turkey, bbl.....lb.	.04 - .04	.04 - .04	.04 - .04
Chrome green, bbl.....lb.	.27 - .29	.27 - .29	.28 - .30
Carmine red, tina.....lb.	4.50 - 4.75	4.25 - 4.50	4.50 - 4.70
Paro toner.....lb.	.90 - .95	.90 - .95	.100 - 1.10
Vermilion, English, bbl.....lb.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Chrome yellow, C. P., bbl.....lb.	.18 - .19	.18 - .19	.16 - .17
Ocher, French, casks.....lb.	.02 - .03	.02 - .03	.02 - .03
Feldspar, No. 1 (f.o.b. N. C.)ton	6.50 - 7.25	6.50 - 7.25	6.50 - 7.00
Graphite, Ceylon, lump, bbl,lb.	.07 - .07	.07 - .07	.05 - .06
Gum copal, Congo, bags.....lb.	.08 - .09	.08 - .10	.09 - .14
East Indian, bags.....lb.	.14 - .15	.14 - .15	.16 - .18
Manila bags.....lb.	.14 - .16	.14 - .16	.18 - .19
Damar, Batavia, cases.....lb.	.28 - .28	.28 - .28	.23 - .24
Kauri, No. 1 cases.....lb.	.57 - .65	.60 - .65	.60 - .65
Kieselguhr (f.o.b. N. Y.)ton	50.00 - 55.00	50.00 - 55.00	50.00 - 55.00
Magnesite, calc.,ton	35.00 - 42.00	35.00 - 42.00	35.00 - 40.00
Pumice stone, lump, bbl,lb.	.06 - .08	.06 - .08	.05 - .06
Imported, casks.....lb.	.03 - .40	.03 - .40	.03 - .35
Pyrites, Span., fines, cif., unit	.11 - .12	.11 - .12	.10 - .10
Domestic, fines (f.o.b. Ga.) unit	.12 -	.12 -	.10 - .11
Shellac, orange, fine, bags.....lb.	.62 - .65	.66 - .68	.56 - .58
Bleached, bonedry, bags.....lb.	.67 - .69	.67 - .69	.64 - .66
T. N., bags.....lb.	.58 - .59	.58 - .59	.54 - .55
Soapstone (f.o.b. Vt.), bags, ton	7.00 - 7.50	7.00 - 7.50</	

Industrial Developments of the Week

New Construction and Machinery Requirements in the Process Industries

Outstanding Opportunities

Acids	Elizabeth, N. J.
Alcohol	Philadelphia, Pa.
Aspirin	Windsor, Ont.
Brass, etc.	Chicago, Ill.
Brick	Sanford, N. C.
Candy	Philadelphia, Pa.
Cement	Detroit, Mich.
Cement	Dawson, Okla.
Cottonseed oil	Plainview, Tex.
Cottonseed oil	Tucson, Ariz.
Fireworks	Hanover, Mass.
Gypsum	Sweetwater, Tex.
Linoleum	Philadelphia, Pa.
Oil	Burnaby, B. C.
Oxygen	Chattanooga, Tenn.
Paint	Cleveland, Ohio
Paper	Brokaw, Wis.
Paper	West Linn, Ore.
Paper	Fitchburg, Mass.
Paper	Tacoma, Wash.
Paper	Three Rivers, Que.
Porcelain	Trenton, N. J.
Pottery	Niles, O.
Soap	Cambridge, Mass.
Steel	Johnstown, Pa.
Sulphuric Acid	West Tulsa, Okla.
Varnish, etc.	Philadelphia, Pa.

New England

Me., Rumford—Oxford Paper Co., awarded contract for the construction of an 80 x 130 ft. plant addition, to F. A. Rumery & Co., 537 Congress St., Portland. Estimated cost \$50,000.

Mass., Cambridge (Boston P. O.)—Lever Bros., Broadway, awarded contract for the construction of a 3 story factory, for the manufacture of soap, to Walsh Bros., Hampshire St., Estimated cost \$40,000.

Mass., Fitchburg—Crocker Burbank & Co., awarded contract for the construction of a 2 story, 60 x 255 ft. addition to Mill No. 8, for the manufacture of paper, to Wiley & Foss, Central St., Estimated cost \$100,000.

Mass., Hanover—National Fireworks Co., plans the construction of a factory to replace recent fire loss. Estimated cost \$40,000. Architect not selected.

Mass., Malden—Charles Nidener's Sons Co., will soon award contract for the construction of a 3 story factory addition, for the manufacture of fire hose, on James St., Estimated cost \$40,000. C. T. Main, 220 Devonshire St., Boston is engineer and architect.

Mass., Wakefield—Bd. of Selectmen plans the construction of a municipal water gas plant. Estimated cost \$100,000. Architect not selected.

Mass., Westfield—American Abrasive Co., plans the construction of an addition to its plant here. Estimated cost \$25,000.

Mass., Worcester—Warren Belting Co., Arctic St., awarded contract for the construction of a 2 story, 48,000 sq.ft. plant for the manufacture of leather belting, on Arctic St., to E. J. Cross Co., 82 Foster St., Estimated cost \$50,000.

Mass., Woronoco—Stratmore Paper Co., is having plans revised for the construction of a 4 story, 45 x 200 ft. addition to mill. L. Howes is company engineer.

Middle Atlantic

Md., Baltimore—Bd. of Awards will soon award contract for the construction of superstructures of buildings and additions to Montebello filters, including a chemical building, etc. V. B. Siems, City Hall, is water engineer.

Md., Canton (Baltimore P. O.)—Gold Dust Corporation, 239 West 30th St., New York awarded contract for the construction of a 2 and 3 story plant, here, to Consolidated Engineering Co., 20 East Franklin St., Baltimore. \$1,000,000.

N. J., Elizabeth—Kalfleisch Corporation, Baltic St., H. L. Derby, Pres. plans the construction of a plant for the manufacture of acids and chemicals. Estimated cost \$200,000. Engineer not selected.

N. J., Trenton—Circle F Manufacturing Co., Monmouth St., awarded contract for the construction of a 5 story, 40 x 100 ft.,

This page is of value not only as a machinery market but also as an index of the general activity and growth of the industries served by Chem. & Met. The reports are gathered by our regular correspondents who are instructed to verify every detail. Requirements for new machinery will be published here free of charge.

porcelain factory and office building, to W. C. Ehret, 13 West State St. \$125,000.

Pa., Creighton—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, will build five 2 story buildings, as additions to plant here. Estimated cost \$4,000,000. Work to be done by separate contracts. Company engineers in charge.

Pa., Johnstown—Cambria Steel Co., E. G. Grace, Pres., plans the construction of 70 coke ovens at the Franklin works. Estimated cost \$2,500,000.

Pa., Philadelphia—G. W. Elalon, 21st St. and Hunting Park, awarded contract for the construction of a 4 story, 30 x 90 ft. factory for the manufacture of linoleum, at plant to W. Steele & Sons Co., 219 North Broad St.

Pa., Philadelphia—Certenteed Products Co., 2nd and Erie Sts., awarded contract for the construction of a 83 x 113 ft., oil and varnish factory, to Stofflet & Tillotson, Wes Bldg.

Pa., Philadelphia—David Berg Alcohol Co., Delaware Ave., and Tasker St., awarded contract for the construction of a 62 x 120 ft. fermenting and still house, to W. Steel, 209 North Broad St.

Pa., Philadelphia—Minter Bros., 5051-61 Lancaster St., awarded contract for the construction of a 3 story, 74 x 146 ft., candy factory at plant, to W. R. Dougherty, 610 Lansom St.

Pa., Pittsburgh—Baltimore & Ohio R.R. Co., Baltimore, Md., is having plans prepared for the construction of a 2-story, water softening plant at 36th St., here. Estimated cost \$20,000. Chemical equipment will be purchased. H. A. Lane, B. & O. Bldg., Baltimore, Md., is chief engineer. P. Didier, Maloney Bldg., Pittsburgh, is assistant chief engineer.

Pa., St. Mary's—St. Mary's Clay Products Co., is receiving bids for the construction of a brick plant. Estimated cost \$500,000. C. A. Searing, Farmer's Bank Bldg., Pittsburgh, is engineer.

South

Ala., Sheffield—Colbert Lime Rock Asphalt Co., c/o J. R. Scott, 616 Eastgate Ave., St. Louis, Mo., et al., plans construction of a lime rock asphalt plant in Colbert County, near here, on 550-acre site. Estimated cost \$100,000.

Ala., Cordova—L. L. Stephenson, Brick Co., 2027 Fourth Ave., North Birmingham, is report to plan the construction of a plant, for the manufacture of manganese grey and buff stiff brick, on newly acquired 1600-acre site. Estimated cost \$300,000.

Fla., Tampa—Kreiss Potassium Phosphate Co. is reported to have started the construction of a potassium phosphate treating plant, on the Estuary; main building, 65 x 528 ft., warehouses, 65 x 185 ft. and 125 x 350 ft. capacity, 25,000 tons for each unit. Will import fertilizer materials and supply potassium phosphate for domestic and export trade. Several contracts have been awarded. Estimated cost \$500,000.

N. C., Sanford—Borden Brick & Tile Co., c/o Chamber of Commerce, plans the construction of a plant for the manufacture of hollow tile, capacity of 150 tons per day. Electric machinery will be required. Estimated cost \$200,000.

Pa., Roanoke—Vicose Corporation of America, Marcus Hook, Pa., will soon

award contract for the construction of a 1 and 2 story, 198 x 582 ft. addition to plant on the Roanoke River, here. Ballinger Co., 12th and Chestnut Sts., Philadelphia, is architect.

Va., Portsmouth—Portsmouth Oxygen Corporation, is building an electrolytic hydrogen and oxygen plant, 350,000 cu.ft. per minute capacity. Estimated cost \$50,000. C. V. Serbell is chief engineer.

W. Va., Huntington—A. C. Love, 1123 Fourth Ave., is in the market for an electric welding outfit, 4 kw. generator, 200 ampere, 60-20v., direct connected to 3 ph., 60 cyc., 220 v. motor.

Middle West

Ill., Chicago—Dallas Brass & Copper Co., 820 Orleans St., is in the market for additional machinery and equipment for new copper and brass foundry. H. C. Bauer is purchasing agent.

Ind., Indianapolis—Standard Sanitary Manufacturing Co., Bessemer Bldg., Pittsburgh, Pa., awarded contract for the construction of a 2 story, 160 x 300 ft. factory at Pratt and Senate Sts., here, to Thompson Binger Co., Inc., 223 New Jersey St. Estimated cost \$160,000.

Mich., Detroit—Peerless Portland Cement Co., 2410 First National Bank Bldg., plans the construction of a 70 x 156 ft., finishing mill for portland cement factory. Estimated cost \$50,000. A. Kahn, 1000 Marquette Bldg., is architect.

Mich., Ontonagon—Northern Fibre Co., D. C. Everest, Pres. 601 McIndoe St., Wausau, Wis., plans the construction of a 2 story, 72 x 177 ft., addition to paper mill, here. Private plans. Additional wet machines will be purchased.

Mich., Ontonagon—Ontonagon Fibre Co., D. Everest, 601 McIndoe St., Wausau, Wis., awarded contract for the construction of a 3 story, 77 x 140 ft., addition to paper mill, here. W. F. Milford, Calumet, Mich.

Ohio, Akron—Philadelphia Rubber Works Co., Bartges St., awarded contract for the construction of a 2 story, 42 x 153 ft. office building and remodeling 2 story, 58 x 248 ft. factory at plant, here, to C. W. & P. Construction Co., 718 Second National Bldg. Estimated cost \$100,000.

Ohio, Cleveland—Parr Paint & Color Co., 665 East 103rd St., has had plans prepared for the construction of a 3 story, 40 x 80 ft. factory on Syracuse Ave. Estimated cost \$50,000. A. C. Bishop & Co., Guardian Bldg., is architect.

Ohio, Niles—Atlas China Co., A. R. Ahrndts, Pres. awarded contract for the construction of a pottery art plant to replace fire loss, to H. K. Ferguson Co., 4900 Euclid Ave., Cleveland. Estimated cost \$200,000.

Ohio, Sebring—Limoges China Co., plans the construction of an addition to plant. Estimated cost \$40,000.

Ohio, Sebring—Sebring Pottery Co., plans the construction of an addition to pottery plant. Estimated cost \$50,000.

Wis., Beaver Dam—Beaver Dam Fibre Co., O. Olman, Juneau, Secy., will build a 72 x 130 ft. hemp plant, and 24 x 250 ft. dry kiln, by day labor here. Estimated cost \$50,000. Private plans. Special machinery with electric motors will be purchased.

Wis., Brokaw—Wausau Paper Mills Co., W. L. Edmunds, Gen. Mgr., will build a 3 story, 80 x 96 ft. addition to bleater room for bleacher plant, by day labor. Estimated cost \$125,000. Motors, screens and wet machines will be purchased. L. D. De Guere, Wisconsin Rapids, is engineer.

Wis., Madison—French Battery Co., 2317 Winnebago St., awarded contract for the construction of a 106 x 302 ft. battery plant and warehouse, to G. Nelson, 1117 West Johnson St. Estimated cost \$40,000.

Wis., Menasha—Menasha Printing and Carbon Co., River St., awarded contract for the construction of a 42 x 60 ft. factory addition, to C. R. Meyer & Son Co., 5 State St., Oshkosh. Estimated cost \$25,000. Equipment for the manufacture of paraffin wax will be purchased.

Wis., Milwaukee—Roberts Brass Co., 178 Lincoln Ave., awarded contract for the construction of a 2 story, 70 x 106 ft., addition to factory, on Lincoln Ave., to Meredith Bros. Co., 253 Washington St. Estimated cost \$50,000.

Wis., West Bend—West Bend Canning Co., awarded contract for the construction of a 2 story, 52 x 128 ft. addition to canning factory, to J. Williams. Estimated cost \$45,000. Canning machinery will be purchased.

Wis., New London—Hamilton & Sons Canning Co., will soon award contract for a 3 story, 50 x 150 ft. addition to cannery. Estimated cost \$45,000. Private plans. Canning machinery will be purchased.

Wis., Oconomowoc—Oconomowoc Canning Co., awarded contract for the construction of a 94 x 112 ft. addition to cannery, to Nelson-Weber Construction Co. Estimated cost \$40,000.

Wis., Richland Center—E. B. Prouty, Spring Green, plans the construction of a 2 story, canning factory here. Estimated cost \$40,000. Architect not selected.

Wis., Waukesha—Waukesha Jelly Powder Co., Broadway and East Ave., is having plans prepared for the construction of a 2 story, 52 x 75 ft., manufacturing plant, on Cutler Ave. Estimated cost \$25,000. Special machinery will be purchased. Eckerman & Ruddell, 279 Layton Blvd., Milwaukee, are engineers.

West of Mississippi

Ark., Fort Smith—Fort Smith Cereal Co., 914 Grand Ave., awarded contract for the construction of a 3 and 5 story, 32 x 80 ft., cereal factory, at North 6th St., to J. H. Reddick, Kennedy Bldg. Estimated cost \$80,000.

Mo., Trenton—Trenton Gas and Electric Co., awarded contract for the construction of extensions to water gas plant here, to General Engineering and Management Corporation, 165 Broadway. Estimated cost \$185,000.

Minn., Duluth—Universal Portland Cement Co., R. S. Huey, Supt., will take bids about June 1 for improvements to cement plant at Morgan Park, here. Estimated cost \$250,000. Coy's Engineering Staff, are engineers.

Okla., Dawson—Tulsa Cement Co., Tulsa, I. F. Crow, Pres., has had plans prepared for the construction of a new Portland cement plant here. To be equipped with all grinding machinery, burners, etc., for a modern mill. Estimated cost \$1,500,000. R. E. Clarke, Monadnock Block, Chicago, is engineer.

Okla., El Reno—Chickasha Cotton Oil Co., Chickasha has had plans prepared for the construction of a cotton compress plant, here. Estimated cost \$25,000. Electrically operated machinery will be purchased. Private plans.

Okla., West Tulsa—Wisconsin Acid Co., c/o Chamber of Commerce, Tulsa, is having preliminary plans prepared for the construction of a sulphuric acid plant, to supply the refining industries in the Tulsa district. Estimated cost \$350,000. Architect and engineer not announced.

Tenn., Chattanooga—Burgett Oxygen Co., Alton Park, plans the construction of a new oxygen plant. Estimated cost \$100,000.

Tex., Fort Worth—Traders Oil Mill Co., B. W. Couch, Pres., 3501 South Jennings Ave., plans the construction of plant to replace fire loss. Estimated cost \$100,000.

Tex., Plainview—W. P. Allen, Terrell, et al., reported as interested in the construction of a cottonseed oil mill here. Estimated cost \$125,000.

Tex., Sweetwater—United States Gypsum Co., plans the construction of addition to present plant to double capacity. Estimated cost \$200,000. Company engineers in charge.

Far West

Ariz., Tucson—Tucson Cotton Oil Co., Box 1586 has work under way on the construction of a cotton seed oil plant, 40 ton capacity. Estimated cost \$75,000. O. J. Perry, Gen. Mgr., 811 North 3rd St., Phoenix, is engineer.

Calif., Merced—American Can Products Co., 756 South Broadway, Los Angeles, is having plans prepared for the construction of a 85x225 ft. canning plant, here. Estimated cost \$80,000. Moran & Co., Kerckhoff Bldg., is architect.

Calif., Merced—Merced Tomato Products Co., will build a 2-story, 80 x 100 ft. cannery, by day labor. Estimated cost \$75,000.

Calif., Oakland—Pacific Gas & Electric Co., 445 Sutter St., San Francisco, is having plans prepared for the construction of a gas generator, with 5,000,000 cu.ft. per day, capacity. Company engineers in charge.

Calif., Oakland—Tyre Bros., Glass Co., 666 Townsend St., San Francisco, is having plans prepared for the construction of a factory, at 7th and Cypress Sts. Estimated cost to exceed \$40,000. M. H. Lanzit is company engineer.

Calif., San Francisco—Quality Enameling & Porcelaining Co., 1634 Howard St., awarded contract for the construction of a 1 and 2 story, 100 x 160 ft., factory at San Bruno and Cortland Aves., to the Austin Co. of California, Santa Fe Bldg.

Calif., Tulare—Los Angeles Creamery Co., K St., is having plans prepared for the construction of a 35 x 115 ft. casein and condensed milk plant. Private plans.

Ore., West Linn—Crown Willamette Paper Co., Pittock Bldg., Portland, awarded contract for the construction of a 4 story, 100 x 100 ft. paper mill, to be first of three unit plant, on the Willamette River, here, to A. Guthrie, Sherlock Bldg., Portland. Estimated cost \$200,000. Owner will purchase complete machinery for 100 ton paper mill. Wood pulp and linen and rag mills will be constructed later. Company engineers are in charge.

Wash., Tacoma—Cascade Paper Co., West Tacoma, plans the construction of a pulp mill adjoining present paper plant at Chambers Creek here. Plans include a wood chipping plant, rotary incinerator, lime recovery kiln, finishing room, etc. Estimated cost \$400,000.

Canada

B. C., Burnaby—Union Oil Company of California, 404 Pender St., West Vancouver, plans the construction of an oil refinery, on 45 acre site, on the Burrard Inlet, here. R. J. Kemnair, 404 Pender St., West Vancouver, is agent.

Ont., Dundas—Kaustine Manufacturing Co., is enlarging plant for the manufacture of chemical toilets, septic tanks, etc., to double its present capacity. Estimated cost \$50,000.

Ont., Listowel—City Dairy Ltd., Spadina Crescent, Toronto, is having plans prepared for the construction of a 2 story, plant for the manufacture of powdered and condensed milk, here. Estimated cost \$100,000. Gore, Nasmith & Storrie, Confederation Life Bldg., Toronto, are engineers. Owner will purchase equipment for the manufacture of condensed and powdered milk.

Ont., New Liskeard—O. Corser, is in the market for complete equipment for new canning factory. Estimated cost \$40,000.

Ont., Windsor—Bayer Aspirin Co., H. L. Shadie, Mgr., is receiving bids for the construction of a factory. Estimated cost \$200,000.

Que., Three Rivers—Wayagamack News Co., Ltd. awarded general contract for the construction of a paper mill, to the Foundation Co., Ltd., 224 St. James St., Montreal. Estimated cost \$3,000,000.

Incorporations

Insulex Corp., Dover, Del., metallurgical operations, \$500,000.

Security Portland Cement Co., \$500,000.

Du Pont Everdur Co., Dover, Del., non-ferrous metals, etc., \$500,000.

Ecleppo Products Corp., Dover, Del., articles of brass, aluminum, and iron, \$2,500,000.

American Rayon Products Corp., Dover, Del., manufacture artificial silk, etc., \$11,000,000.

Scott County Petroleum Co., Dover, Del., petroleum and mineral gases, \$1,500,000.

Tennessee Petroleum Co. of America, Dover, Del., petroleum and mineral gases, \$100,000.

North Carolina Amesite and Stone Co., Dover, Del., \$6,200,000.

Dentorrhia Laboratories, Inc., Dover, Del., chemists, \$2,100,000.

McAdoo Petroleum Corp., Dover, Del., \$11,000,000. (United States Corp. Co.)

Pratt Coal & Byproducts Corp., Wilmington, Del., mining rights, \$2,500,000. (Corporation Trust Co. of America).

National Products Corp. of America, Wilmington, Del., rubber \$1,500,000. (Corporation Trust Co. of America).

Urbain Corp. of New York, Dover, Del., carbon products including gases and oils, \$110,000,000. R. J. Gorman, H. C. Hand, S. G. Wood, New York City. (United States Corp. Co.)

Frontier Petroleum Co., Wilmington, Del., mining and manufacturing, \$500,000. (Lawyer's Corporation Co.)

Colorado Fluospar Co. of New York, capital increased from \$100,000 to \$700,000.

Minnesota Carbon Black Co., Wilmington, Del., manufacturing, \$200,000. (Atty. P. F. Garrett, Wilmington, Del.)

Western Amesite Asphalt Co., Wilmington, Del., \$12,100,000. (Delaware Registration Trust Co.).

Celastic Corp., Wilmington, Del., colloid treated fabrics, \$1,000,000. (Atty. C. Copeland, Wilmington).

Pocahontas Tile & Ochre Corp., manufacture, \$1,550,000. R. B. Jester, New Cumberland, W. Va., G. C. Mackreth, C. H. Conrad, Pittsburgh, Pa., (Capital Trust Co. of Delaware).

Tampa Tire Co., \$50,000. J. H. Baskin, J. T. Littlefield, J. E. Reis, Tampa, Fla. (Capitol Trust Co. of Delaware).

Songy Sugars Co., Inc., New Orleans, La., \$204,000. P. G. Songy, Vice Pres., A. J. Crozat, Secy.

United Finish Co., Peabody, Mass., manufacture leather finishes, \$50,000. C. B. Murray, Peabody; C. H. White, Beverly; P. J. Gilligan, Salem.

Marketing Products Inc., Boston, Mass., fertilizers, \$25,000. J. M. Eaton, R. M. John, and C. E. Eaton.

J. Mendlowich & Sons, Newark, N. J., tan and finish leather, \$50,000. J. Mendlowich, S. Z. Mendlowich, L. B. Mendlowich. (Atty. H. R. Dolan, Newark).

Wolverine Lubricants, New York, 100 shares, Class A, and 5,500 shares, Class B, no par value. W. K. Hogan, J. J. Traub, J. Wienken. (Atty. Edwards & Bryan, 31 Nassau St.)

Resinilla Corporation, New York, flavoring extracts, etc., 1,000 shares at \$10 each, 50 common, no par value. E. T. Beamish, N. D. Dale, H. R. Flick, (Atty. Beamish & Steinbugler, 189 Montague St., Brooklyn).

Baxter-Lane Paper Corp., New York, \$150,000. I. S. Baxter, H. V. Farrell, J. C. Noonan. (Atty. Graves, Miles & Hawger, 111 Broadway).

Collar City Paper and Board Manufacturing Co., Troy, N. Y., \$50,000. J. and J. R. and H. S. Symansky. (Atty. Clinton, Scott & McNamee, Troy).

Flexo Products Co., Le Roy, N. Y., manufacture cleaning materials, compounds, preparations and chemicals, 250 shares at \$100 each and 250 common shares, no par value. H. B. Ward, J. A. Farr, W. M. Aiken, L. E. Whitlock, O. C. Curtis, all of Le Roy.

Whitehall Paper Mill, New York, \$20,000. B. Rosenberg, M. H. Kotzen, M. M. Seigel. (Atty. Kotz Bros., 31 Chambers St.)

Motorkoll Corp., New York, oils, \$1,150,000. A. Danville, T. H. Dobbiss, T. Kennedy. (Atty. Metcalf & Allen, 331 Madison Ave.)

Alatary Mica Co., New York, N. Y., mineral products, 250 shares, at \$100 each, 100 common shares, no par value. A. T. Kraut, J. Dubl, E. H. Taussig. (Atty. J. Tietelbaum, 305 Broadway).

Niagara Electro Chemical Co., New York, N. Y., 1,000 common shares no par value. C. L. Hays, S. F. Fearbake, F. A. Huck. (Atty. Merrill, Rogers, Gifford & Woody, 60 Broadway).

Roessler & Hasslacher Chemical Co., formed by the consolidation of Roessler & Hasslacher Chemical Co. and the Niagara Electro Chemical Co., \$6,000,000. F. Roessler, W. A. Hamlin, H. R. Garveth. (Atty. Merrill, Rogers, Gifford & Woody, 60 Broadway, New York).

Eastern Oklahoma Amesite Co., Muskogee, Okla., \$100,000. W. E. Deleant, D. McInerney.

Spokane Oxy-Acetylene Co., Spokane, Wash., \$200,000. H. Russell, E. L. May.

Vegetable Oil Soap Co., Marmora, Ont. \$50,000.